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THE FORMATION AND CONDUCTING OF DAIRY- HERD-TESTING ASSOCIATIONS.

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AS recently as the year 1909 dairy-farming in New Zealand was carried on practically without any systematic study of the performance of individual cows. Cows were selected on appearance and milk-flow, fed little beyond ordinary pasture, and mated with bulls lacking known butterfat-record ancestry. The average dairy-farmer was content with his knowledge of his herd, and it was not until the more general use of the Babcock tester that many fallacies were revealed and a keener interest in dairy stock resulted. In August, 1909, our first cow-testing association was organized in the Wairarapa district. The work was carried out by the Dairy Division, with the co-operation of the Dalefield Dairy Company and a number of its milk-suppliers, 815 cows being systematically tested. The following season brought requests for similar assistance from other districts, which resulted in the testing of 4,317 cows. And so the numbers have gone on increasing, until in the 1923-24 season over 150,000 cows, or 12 per cent. of the Dominion's dairy cows, were tested for butterfat yield. Of these, the work for 37,378 cows was carried out by officers of the Dairy Division, and the remainder by privately controlled associations.

Cow-testing forms the key to successful dairying. To ascertain the profits of his labours the dairy-farmer must compare the cost of

running his herd with the value of that herd's output, and the scales and Babcock tester often stand between failure and success. Post-war conditions have reduced the margin between cost of production and market values, until many dairy farms can no longer pay unless stocked with profitable producers. There are, of course, other factors—feed, care, and so forth—but the cow must be worthy of that attention.

THE ASSOCIATION SYSTEM.

The system originally recommended by the Dairy Division, and still very generally in vogue in New Zealand, provides for the weighing and sampling of each milking for two consecutive days in each thirty days. For sampling, a bottle with a capacity of about 4 fluid ounces—known as a "4 oz. milk-sample bottle"—is used. A 1 oz. sample, measured by means of a 1 oz. dipper, is taken from each milking and mixed in the one bottle, thus forming a composite sample. The samples are taken and the milk-weights recorded by the association member. The milk-weights are entered on a form specially provided for the purpose by the Department. The samples are placed in a specially constructed milk-sample box, the weight sheet included, and sent to the testing-depot—usually the dairy factory to which the herd-testing association member is a supplier. The testing officer then tests the samples and enters the result alongside each cow's name in the space set aside for the purpose on the form, which also contains the record of the milk-weights. When this part of the work is completed the record is calculated, and the sheet with the completed results is sent to the herd-owner. Before returning the sample-box to the member, in readiness for the taking of the next samples, the testing officer washes and drains the bottles and adds a sufficient quantity of preservative.

When a herd-testing association is initiated among the suppliers to a large dairy factory it is considered advisable that the membership should not include the suppliers of another company, unless there be some strong reason to the contrary. This avoids difficulty in the prompt receipt of samples at the testing-room, and decreases the likelihood of friction between suppliers. It is often found, however, that suppliers to a number of small or medium-sized factories can support one good association by co-operating, whereas failure might ensue if they ventured separately. In such cases co-operation is advisable.

FORMING THE ASSOCIATION.

Probably the most simple method of arranging the formation of a herd-testing association is by a general resolution at the dairy company's annual meeting. It is considered desirable that an association should be part and parcel of the company's operations, the total cost being a charge against the company's general expenses. The only objection to this method is the possible opposition by suppliers who do not desire their herds tested, and who would therefore be against the increased expenditure necessitated by this work. Even from this point of view, however, there is the fact that herd-improvement means an increased supply to the factory, and a decrease in manufacturing-costs should be the tendency of such a result.

If it is agreed that the cow-testing work should not be carried on under the same organization as the usual factory-work an independent association may be formed. In that case it is reasonable to expect that the dairy company among whose suppliers the association is formed would be agreeable to permit the association the use, free of cost, of its testing-machine, testing-room, and steam.

Another system, though a more costly one, consists in the appointment of an independent testing officer to visit each farm, take the samples, check the milk-weights, and do his own testing and figuring. In this case only one day's milkings are checked and tested, and the number of members is obviously restricted to the number of farms the testing officer is able to visit in the month. Concerning this point of one-day testing, there are some association members who are inclined to consider one day's samples sufficient. The Dairy Division has always advocated the sampling and weighing of each milking for two consecutive days in each thirty-day period. Cows are found to vary a good deal from day to day in both milk and test, and experience has shown that if a cow is down in milk-weight or test one day she is often up the next, and thus the irregularity is counterbalanced.

This also applies, of course, to cows which may test or milk abnormally high on the first day of the testing. When samples from four milkings are mixed in the one composite sample one abnormal test (either higher or lower than the normal) does not have so much influence on the result as would one abnormal milking in the case of only two samples. Were the samples taken over an exact twenty-four hours, tested separately, and figured in conjunction with the weight of the individual milking to which the sample refers (as is the case with the certificate-of-record testing of purebred dairy cows) an abnormal test would not bear so marked an influence. It has to be recognized that a two-day sample is, owing to cost, out of the question if samples are to be taken by an independent testing officer. The system which provides for the employment of such an officer is to be recommended strongly where the owners are not disposed to have the milk weights and samples properly taken by themselves, or at their direction. The system under which the independent testing officer is employed is often the best for overcoming the difficulty presented by the releaser milking-machine.

In the event of an association being conducted independently of the dairy company the following by-laws are suggested as a guide :—

1. Any dairy-farmer supplying this co-operative dairy company will be admitted to membership if he agrees to weigh and sample night and morning for two consecutive days in each testing-period the milk of each and every cow subscribed for test. The number of members may be limited by the committee of management.
2. Members shall provide balances for weighing the milk, a dipper for sampling, a sample-bottle properly numbered for each cow, and a box for holding these bottles.
3. Members shall undertake the delivery of their samples for testing at the factory or station where the testing is done.
4. The testing shall be done by the Babcock method.
5. Any member wilfully returning incorrect weights or samples shall be refused permission to take further part in the work of the association.
6. Each cow once tested shall be counted as a cow for the season.

SAMPLING AND WEIGHING THE MILK.

It is widely recognized that in order to ascertain the yield of dairy cows with absolute accuracy the weighing and sampling of the milk at each milking are essential. Such accuracy, however, is only necessary in the making of official records, and the system is seldom undertaken except with purebred dairy cows. Needless to say, such practice is not considered within the scope of herd-testing association work. Recognizing that dairy-farmers did not demand such accuracy in connection with their individual-cow records, and that very few could be induced to undertake such a task, the Dairy Division in the first place decided to merely ask members of associations to weigh and sample the milk from individual cows for two consecutive days in each thirty-day period. It was further suggested that if cows were in ill health, or otherwise out of their normal condition, such weighing and sampling should be deferred until normal conditions again obtained. Good reliable work can be done in this way, and results have shown that the estimated yield in many instances shows only a narrow variation from the actual yield according to the factory returns. The question of one *versus* two days' sampling and weighing has been treated previously.

Following is a copy of a circular of instructions which is sent by the Dairy Division to members before the first weighing and sampling take place :—

Instructions for Weighing and Sampling at the Farm.

1. The spring balance should be hung in a place which will be most convenient. A plentiful supply of light ensures more accuracy in taking the weights, and also saves time.
2. The blank form (No. 1) for the record of the weights of the several milkings, &c., should be attached to a smooth flat board, and hung near the spring balance. A pencil should be fastened to this board with a string of the necessary length.
3. Immediately after milking, the milk should be poured into the weighing-bucket and sampled at once. The weight should then be recorded, and the milk delivered to the can. One pouring of the milk is sufficient, and enables a representative sample to be taken.
4. Be sure that each sample-bottle bears the number which corresponds to that of the cow.
5. The names of cows should be entered on the No. 1 form in the same order for each period right throughout the season. Farmers should keep a copy of the No. 1 form for the first testing-period, so that they shall know the order in which they have placed their cows. This is important.
6. The preservative is placed in the sample-bottles at the testing-depot, and with the addition of each sample a gentle rotary motion should be given to ensure proper distribution of the preservative.
7. The sample-bottles should always be kept well stoppered. Evaporation of moisture from the samples impairs the accuracy of the test.
8. When the sample-box is on the farm it should be kept under lock and key, and outside the reach of children, as the preservative used is poisonous.
9. As soon as the four samples have been taken, the box should be despatched to the testing-station, and the sheet containing the weights of the milk should be enclosed in the box.
10. If cows are "in heat" or otherwise out of their normal condition the weighing and sampling of their milk should be deferred until they have recovered their normal condition. Such samples could probably be brought to the testing-depot before the testing is finished.

The weighing is done by means of a spring balance of the hook or quadrant type. Good strong balances of assured accuracy should

be used. Weights of milk are usually indicated to half a pound, and the balances used should be graduated accordingly. Members should be careful to deduct the exact tare of the weighing-bucket used. Buckets and tins vary considerably in weight, and it is therefore more satisfactory to keep one particular bucket on the hook during the weighing and sampling period.

SAMPLING REQUISITES.

Bottles: Four-ounce milk-sample bottles, specially designed for cow-testing association work, and provided with a suitable cork, are easily procurable. The four samples should fill these bottles to within $\frac{1}{2}$ in. of the cork. If filled too full, difficulty is experienced in getting the cream thoroughly incorporated, thus affecting the accuracy of the test. These bottles are provided with brass bands around the neck, and on this band is stamped the number which corresponds to the cow which has been given the same number. For the purposes of compilation of testing returns cows are known by numbers and not names. If the cow's name were also put on the bottle it would probably save time in sampling, and avoid possible errors by putting the sample in the wrong test-bottle. If the papers bearing these names are gummed on the bottle, and coated over with two applications of white shellac, they should stick very well despite the washing.

Preservative: For keeping milk-samples in good condition until tested, powdered bichromate of potash is usually used. About as much as will cover a threepenny-piece is sufficient. The same preservative in tablet form is very convenient, though much more costly than the powder. In warm weather, or when the samples have to be kept some time before testing, a mixture of one part of corrosive sublimate to two parts of bichromate of potash has been found effective. Formalin in liquid form is sometimes used, but its use is not recommended. It has two principal disadvantages: First, milk treated with formalin does not always mix satisfactorily with the acid used in the process of testing; and, second, formalin is colourless, and thus it cannot be told at sight whether or not this preservative has been added.

Sampling-dipper: The sampling-dipper should be of such capacity that four samplings will fill the bottle to within about $\frac{1}{2}$ in. of the cork. A reasonably short handle contributes to surer work.

Milk-sample box: The box should be made of fairly strong material, so as to be serviceable for some years. Those in use are rectangular in shape, the dimensions varying according to the number of bottles they are required to hold. One-inch boards, dressed, make a good serviceable box. Provision should be made against the splitting of the lid of the box. It is also necessary to provide each box with a lock to secure the bottles, which contain poisonous preservative, from children.

REQUISITES FOR THE TESTING-ROOM.

Provided the dairy company permits the association to use its testing-machine, testing-room, and steam, the other expense, with the exception of test-bottles, will not be large.

It has been found that the provision of sufficient test-bottles to hold the samples tested in one day facilitates the work. The reason is that at times it is more convenient to obtain a supply of steam in the forenoon, and in such cases the testing officer can do his sampling in the afternoon, and then keep the testing-machine going almost continually the following morning. The fat-percentages can be read off from one lot of bottles while another lot is being whirled. With a convenient room, one man can in this way run through over two hundred samples a day, provided he does not do the washing of the sample-bottles.

A list of the requisites necessary, together with prices, would be somewhat as follows:—

	£	s.	d.
Two gross of Babcock milk-test bottles ..	21	12	0
Packing same	0	2	6
2 lb. powdered bichromate of potash ..	0	5	0
One acid-burette (25 charge) ..	1	15	0
One acid-measure (17.5 c.c.) ..	0	1	3
One pair dividers	0	1	6
Six pipettes (tested)	0	10	0
Three dairy-thermometers (tested) ..	0	10	0
Twelve blocks (with 24 holes) ..	1	16	0
Three boards (with $\frac{3}{8}$ in. holes) ..	0	4	6
Buckets, trays, dipper, &c. (say) ..	2	0	0
Two cases sulphuric acid (244 lb. at 4d.) ..	4	1	4
Total	£32	19	1

A number of these items are usually found in the average factory testing-room. Prices are based on the average of best quotations at time of writing, but can only be taken as a guide.

MEMBER'S OUTFIT.

The items which the association member is asked to furnish are sample-bottles with numbered brass bands (one for each cow), a spring balance, a sampling-dipper, and a box in which to deliver the samples to the testing-depot. For a herd of forty cows the approximate cost (excluding any freight) will be as follows: Forty bottles with brass bands, at, say, 4½d., 15s.; one sampling-dipper, 1s.; one spring balance (strong and tested), 8s.; one box for samples, say, 14s.: a total of £1 18s., or less than 1s. per cow, for the first year, and nothing additional for succeeding years save for replacement of breakages. With smaller herds the cost per cow would, of course, be slightly higher, since the price of the balance and dipper would be divided among the smaller number.

FORMS USED IN RECORDING HERD-TESTING RETURNS.

Three forms are in use by the Dairy Division in connection with this work, known as forms No. 1, No. 2, and No. 3 respectively. Reduced facsimiles of these are here presented.

Form No. 1 is for use at the dairy farm. It provides for the name and address of the member, the dates on which the weighings and samples are taken, the name, breed, age, and date of last calf of each cow, and the weight of each milking during the two-day

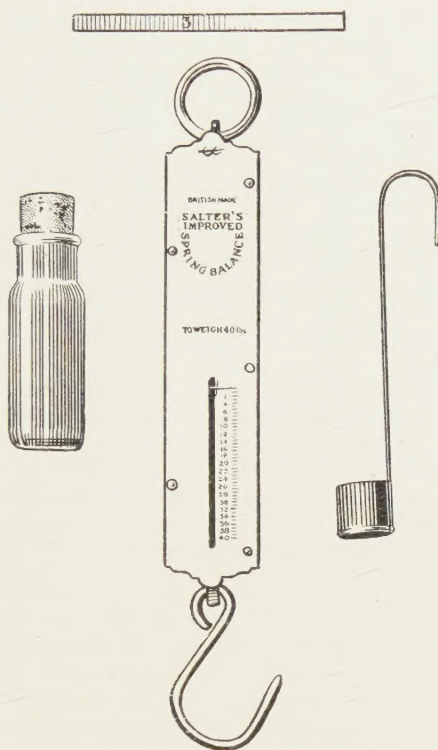


FIG. 1. MEMBER'S OUTFIT: SPRING BALANCE, MILK-SAMPLE BOTTLE, BRASS BAND FOR BOTTLE, AND SAMPLE DIPPER.

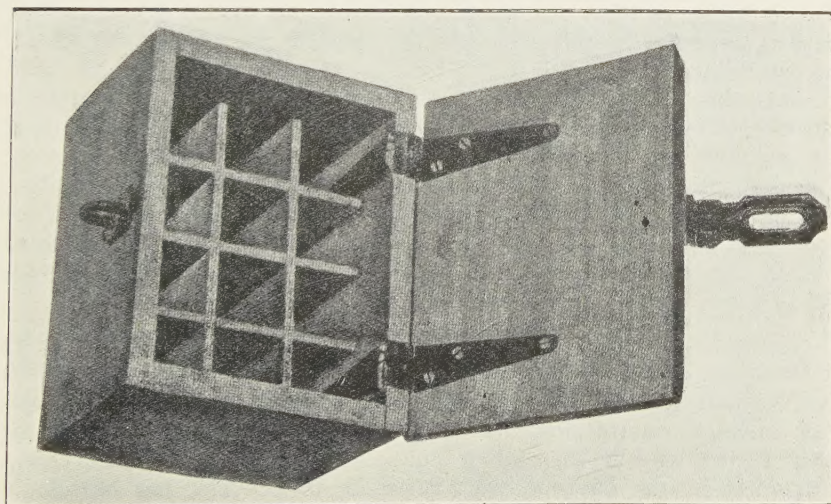


FIG. 2. MEMBER'S MILK-SAMPLE BOX.

sampling-period. These particulars are inserted in each period by the association member, and when complete in this respect the form is enclosed in the box with the samples and forwarded to the testing-depot. This form provides not only for the individual records for each cow for the period, but also for the yield from the date of calving to the close of the period of the test. As the samples are tested, the testing officer enters the result against each cow's number in the space provided for the purpose. This operation completed, the form is passed on to the officer appointed to do the computing of the yields, who fills in the remaining columns—namely, calculated milk for the period; calculated pounds of fat for the period; pounds fat since calving; days in milk since calving; and, at the head of the form, the herd-number, the period-number, and the period closing-date. The form provides for thirty cows, and is numbered accordingly. The Dairy Division also issues a similar form numbered from thirty-one to sixty, to accommodate the returns for larger herds. At the foot of every No. 1 form is space for entering the average yield of milk and fat for the herd for the period, the average test, and the number of cows represented in such average; also, similar particulars for the whole association for the period, so that the member may compare his average cow with the average cow in his association.

Form No. 2 is designed to serve as a permanent record for the office or clerical officer of the herd-testing association. The sheet provides for eleven thirty-day periods. At the head of the form is entered the name of the association, the season, and the name, address, and herd-number of the member. At the head of each "Period" column is a space for the period closing-date, and at the right of the form is entered the name of each cow, the age, breed, and date of calving—this information being copied from the member's first No. 1 sheet on which the cow appears. The "Period" columns themselves exactly coincide with the columns for similar information on the No. 1 form, so that the figures may be transferred by means of carbon paper. Excepting for the first period, the period returns for fat and days are added to the results at the end of the previous period—this, as just stated, being copied on to the No. 2 form from the No. 1 by means of carbon paper. This is the object of running the columns from right to left instead of in the orthodox direction. When the No. 2 sheet is placed over the No. 1 in the proper position the previous period figures are next at hand, and thus convenient for mental computation. At the foot of the form is space for the herd average for the season. This form, similar to form No. 1, provides for thirty cows, with a continuation sheet running from 31 to 60.

Form No. 3 is purely for office record and information. It gives a summary of the production of the various herds in the association for the period. To those associations which will supply the information included on this form to the Director of the Dairy Division for each period, and at the end of the season an annual summary on a similar basis, the Division will undertake to provide, free of cost, a requisite supply of forms Nos. 1, 2, and 3. Form No. 3 provides for forty herds.

FORM NO. 1. *Kopurata* Cow-testing Association. Period No. *4*, ending *5th Nov.*, 1923 Herd No. *6*.
 Name: *John Bull* Address: *Kopurata* Dates of weighings: *20th and 21st Oct.*, 1928.

No.	Name of Cow.	Breed.	Age.	Date of Calving.	Two Days' Weights		Total Two Days	Calculated Milk for Period.	Test.	Lb. Fat.*	Days in Milk.
					A.M.	P.M.					
1	<i>Dorothea</i>				<i>14</i>	<i>12</i>	<i>26</i>	<i>38.25</i>	<i>50</i>	<i>268.23</i>	<i>227</i>
					<i>13½</i>	<i>11½</i>	<i>25</i>	<i>28.98</i>			
2	<i>Lady</i>				<i>11</i>	<i>10½</i>	<i>21½</i>	<i>630</i>	<i>46</i>	<i>156.81</i>	<i>169</i>
					<i>10½</i>	<i>10</i>	<i>20½</i>	<i>27.72</i>			
3	<i>Lucy</i>				<i>8½</i>	<i>7½</i>	<i>16</i>	<i>495</i>	<i>36</i>	<i>129.41</i>	<i>152</i>
					<i>9½</i>	<i>7½</i>	<i>17</i>	<i>44.64</i>			
4	<i>Lily (replacing Agnes)</i>	<i>Grade Jersey</i>	<i>Heifer</i>	<i>28-7-23</i>	<i>17½</i>	<i>13½</i>	<i>31</i>	<i>930</i>	<i>48</i>	<i>148.80</i>	<i>100</i>
					<i>17½</i>	<i>13½</i>	<i>31</i>	<i>38.25</i>			
5	<i>Myra</i>				<i>14½</i>	<i>10½</i>	<i>25½</i>	<i>765</i>	<i>50</i>	<i>64.93</i>	<i>66</i>
					<i>14½</i>	<i>11½</i>	<i>26</i>	<i>35.77</i>			
6	<i>Midget</i>	<i>Jersey Cross</i>	<i>6</i>	<i>1-4-23</i>	<i>12½</i>	<i>10</i>	<i>22½</i>	<i>675</i>	<i>53</i>	<i>700.00</i>	<i>100</i>
7	<i>Note. Cows numbers 4 and 6 were recently bought at a sale. one day's milk</i>										
8							<i>of</i>	<i>1260</i>		<i>213.61</i>	
9											
10											

Herd Average: *6* Cows; *210* lb. Milk; *35.60* lb. Fat; *5.0%* Average test.
 Association Average: *123* Cows; *931* lb. Milk; *37.71* lb. Fat; *4.0%* Average test.

* In the column headed "Lb. Fat" the fat for the thirty-day period is shown in the upper division and the fat since calving in the lower division.

FIG. 3. FORM NO. 1.

The actual form has space for thirty cows.

(Fig. 4—Form No. 2—on next page.)

COW-TESTING FORM NO. 3.

[Ag. $\frac{D}{33}$]

Kopurata Cow-testing Association. Period ending *5th Nov.*, 1923.

Herd No.	No. of Cows.	HERD AVERAGES.			HIGHEST INDIVIDUAL YIELD CALCULATED FOR MONTH.			LOWEST INDIVIDUAL YIELD CALCULATED FOR MONTH.		
		Milk, lb.	Test.	Fat, lb.	Milk, lb.	Test.	Fat, lb.	Milk, lb.	Test.	Fat, lb.
1	<i>20</i>	<i>1042</i>	<i>4.9</i>	<i>51.15</i>	<i>1485</i>	<i>4.5</i>	<i>66.82</i>	<i>895</i>	<i>5.5</i>	<i>48.67</i>
2	<i>12</i>	<i>934</i>	<i>4.7</i>	<i>43.71</i>	<i>1680</i>	<i>4.0</i>	<i>67.20</i>	<i>915</i>	<i>4.1</i>	<i>37.51</i>
3	<i>37</i>	<i>1011</i>	<i>3.4</i>	<i>35.38</i>	<i>1235</i>	<i>4.2</i>	<i>56.07</i>	<i>555</i>	<i>4.0</i>	<i>22.20</i>
4	<i>22</i>	<i>963</i>	<i>4.8</i>	<i>39.39</i>	<i>1200</i>	<i>4.9</i>	<i>58.80</i>	<i>420</i>	<i>3.7</i>	<i>15.54</i>
5	<i>26</i>	<i>755</i>	<i>3.6</i>	<i>27.02</i>	<i>1230</i>	<i>4.1</i>	<i>50.43</i>	<i>660</i>	<i>2.0</i>	<i>13.20</i>
6	<i>6</i>	<i>710</i>	<i>5.0</i>	<i>35.60</i>	<i>930</i>	<i>4.8</i>	<i>44.64</i>	<i>630</i>	<i>4.6</i>	<i>28.98</i>
7										
8	<i>123</i>	<i>114531</i>		<i>4639.28</i>	<i>(Association Totals)</i>					
9		<i>931</i>	<i>4.0</i>	<i>37.71</i>	<i>(Association Average)</i>					
10										

FIG. 5. FORM NO. 3.

The actual form has space for forty herds.

FORM No. 2. *Hopnata* Season: 1923-1924 Name: *John Buell* Address: *Hopnata* No. *6*

FORM NO. 2.										Hesperata										COW-TESTING ASSOCIATION										Season - 1923-1924										Name: John Bull										Address: Hesperata										40-2 No. 6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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SUGGESTIONS FOR PERSONS ENGAGED IN THE COMPILATION OF HERD-TESTING RETURNS.

Persons undertaking the compilation of herd-testing returns, and not previously experienced in this work, sometimes find a little trouble in getting a grip of the system. To help them, and also with a view to uniformity in the system adopted by the clerical officers of the various herd-testing associations in the Dominion, the following detailed guide has been prepared:—

Name and Address of Member.—Members should supply name and full postal address on each return throughout the year. This will avoid returns going astray as the result of being insufficiently addressed.

Sampling-dates and Dates of Calving.—Members should supply dates of sampling on all returns, and should also indicate exact date of calving on the sheet on which cows appear for the first time.

Period Closing-dates.—On receipt of the first sheets for the season the period closing-dates must be selected. An average is taken of the sampling-dates, and to this date fifteen days are added, thus giving the most suitable closing-date. Due regard, however, must be given to subsequent sampling-dates, in case these may be set earlier or later than in the case of the first period. The samples should be taken as early as possible at the middle of each period throughout the season. The closing-date of the first period being determined, subsequent period closing-dates are set at equal intervals of thirty days.

Names of Cows.—Cows must be kept to same numbers as when first submitted. It is considered wise to stamp all sheets for the first three periods or so as follows: "Cows must be kept to same number throughout season." In cases where cows are sold, withdrawn, &c., the blank may be filled by a freshly calved cow. When returns are received they should be checked off with the particulars on the No. 2 form to see that cows are in the same order.

Breed and Age.—Although we have not insisted on these details being supplied, yet one request should be made where such particulars are not given. Not only is the breed a guide to the identity of the cow, but it is often of interest for statistical purposes.

Date of Calving.—Where only the month of calving can be given, days since calving to the end of the first period should be calculated from the middle of the month, thus making the possible error a minimum. It is the practice of the Dairy Division's head office to stamp the first three or so periods as follows: "Please insert calving-dates for cows freshening since last sampling." It has been found that members repeatedly overlook supplying this information, and also the breed and age of new cows. Where no calving-dates are supplied a copy of all figures for the period for such cows should be kept, and the calving dates requested, instead of holding the member's return until his next No. 1 form is to hand.

Owner's Two Days' Weights.—Weights for each cow should be kept within the heavy lines. It should be insisted that members indicate whether weights are for one or two days, as from the figures supplied it is not always obvious which is the case, especially when it is late in the season and the milk-yield is low. Some members have a tendency to supply only one day's weights even in the flush of the season. This practice should be discouraged, as it does not tend to greatest accuracy. Weights should be given to the nearest half-pound.

Calculated Milk for the Period.—This should be found by multiplying the two days' weights by fifteen, or the one day's weights by thirty. If there is a fraction in the owner's total this should be taken as the next whole pound where it is a half or over. A suitable table can be prepared in connection with calculation of period milk-production, by working out the required milk for all two days' weights from 1 lb. to, say, 100 lb. Where milk-weights are missed for one period but a test is supplied, an average of the weights for the preceding and following periods should be taken.

Tests.—Where tests are not taken, or are not given on account of a broken sample-bottle, spilt or sour samples, &c., they should be averaged for between the previous and the following period tests, and the returns compiled accordingly. Also, abnormally high or low tests should be looked for, and deleted in favour of an average test. Averaged tests should be indicated in red ink.

Period Fat.—Where both tests and the milk-weights are omitted for one period the fat should be averaged between the fat from the previous and following periods, but the practice of averaging should not apply generally where cows miss two periods, as the possibility of error might be large. Oldham tables facilitate the figuring of period fat.

Days in Milk.—For the first period the number of days from calving to the period closing-date should be counted—excluding the day of calving but including the day of closing of the period. In cases where the number exceeds 100 no figures for fat since calving should be given, and the words "Too long" inserted in the "fat" column. Premature calving is accepted for clerical purposes as an ordinary calving.

Fat since Calving.—Fat since calving for the first period is figured on the proportion basis from period fat figures. Fat for each period following is added to the fat from calving to the end of the previous period, and the results transferred direct to the No. 2 form by means of carbon paper.

Period Herd Average.—This is based on the milk, test, and fat for the period only, and should include all cows whether "Too long" or otherwise, and irrespective of age. The columns for milk and fat for the period are totalled, and each total divided by the number of cows. To ascertain the average test for the herd, divide the total milk into the total fat.



FIG. 7. OLDHAM'S HERD-TEST CALCULATING-DEVICE.

For calculating the butterfat for the period the cylinder is revolved until the amount of milk for the two days (shown on extreme left of table) is brought opposite the test row. The amount of butterfat is then given directly opposite the test with which the cow is credited. Device patented by Mr. G. H. Oldham, Hamilton.

Period Summary.—This is entered on form No. 3, and the association period average run out from the period herd-totals. The average milk, the average fat, and the average test for the association should be indicated on each member's sheet in the space provided, in order that he may compare the production of his average cow with the production of the average cow for the association as a whole. The average test is derived by dividing the total period milk for the association into the total period fat for the association. Two-year-olds are included in this summary so far as period averages are concerned. In selecting the lowest yield for the herd two-year-olds should be omitted, but a two-year-old may be the highest cow.

Transferring Figures from Form No. 1 to No. 2.—A strip of carbon paper, sufficiently wide to cover the "Period" column, is placed over such column of the No. 2 form, and the No. 1 form placed over this, so that the columns on both sheets coincide. Care should be taken that the first figure of the fat and days does not fall on the vertical lines on the No. 2 sheet, as in cases where the figure is 1 this sometimes coincides with the line, and in the next period it is omitted through being indistinct, thus dropping either 100 lb. fat or 100 days. Only those cows tested twice or more are, as a rule, charged for. Where a cow dies, or is sold or culled, her place on the form may be filled by a new cow. Care must be taken to bracket the one cow's figures from those of the other in some distinctive manner. In adding the herd averages at the close of the season no figures should be omitted in such cases as the above, provided, of course, that the cow has been in milk 100 days and over. Where a cow finishes one lactation period and commences another during the normal season, the end of the first period should be enclosed in a red bracket, and the second continued in the ordinary way.

Drying-off Dates.—As the season advances all members should be circularized regarding supplying drying-off dates. The "drying-off" date should be entered on the No. 2 form, and the fat calculated to that date. The final figures may be entered in red ink on form No. 2, as they are then more easily detected when adding the totals for the herd. When drying-off dates are received, sometimes the figures to the end of the previous period have to be cut back on account of cows having dried off before the closing of that period, drying-off dates being notified after such period return was posted out. In others some days have to be added on, and the fat calculated from the previous period fat on the proportion basis, and in a similar manner as for the first period.

Annual Summary.—The last figures for each cow are totalled, and the average cow found. Two-year-olds are included, but no cows in milk less than 100 days or more than 365 days. All records above 365 days should be cut back to 365 days for purposes of annual summary. The highest cow may be a two-year-old, but the lowest cow is to be selected exclusive of two-year-olds. The production of the average cow of each association is obtained by dividing the total fat and total days for the association by the total number of cows, as is done in the case of herd figures. Figures for the average association cow should not be obtained by adding the herd averages and dividing by the number of herds, since this does not give an accurate result. This is because the individual herd averages are representative of different numbers of cows, and therefore do not give a correct result when added and divided by the number of herds. The same remarks apply to the monthly summary.

This guide is issued to those concerned in circular form, appended to which is (1) a blank copy of a circular report to be sent to association members, giving the results of the season's work; (2) a table for calculation of milk for period; and (3) a specimen table for calculating days in milk as used in the head office of the Dairy Division.

NOTE.—In connection with the foregoing matter the writer desires to acknowledge the cordial assistance given by Mr. H. G. Philpott, of the Dairy Division office, who has been connected with the testing-work almost since its commencement in New Zealand. His suggestions with regard to forms 1 and 2 referred to, and to improved methods of compiling the records, have been of much value.

THE BUSH-SICKNESS INVESTIGATION.

LABORATORY WORK AND RESULTS.

(Concluded.)

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

COMPOSITION OF PASTURE PLANTS—continued.

THE amount of iron in pasture plants varies with the season and the age of the portion analysed, that portion of the plant grown in spring and summer containing least iron, and that portion which may be collected in late summer and autumn containing most iron. The gradual increase in the iron content is well shown in the examples given in last month's *Journal*. The following analyses of grasses grown on the bush-sick country show that their content of iron may sink below even the small amounts quoted for clovers:—

Table 8. Grasses from Bush-sick Country.

Sample No.	Month collected.	Locality.	Species.	Manuring.	Percentage of Iron on Ash.	Remarks.
D 1257/1	Nov.	Mamaku ..	Cocksfoot ..	Slag and super	0.050	Just coming into flower.
D 1257/5	"	" ..	" ..	Unmanured	0.050	
C 196	Dec.	Te Pu ..	Foxtail ..	"	0.130	In flower.
C 195	"	" ..	Cocksfoot ..	"	0.113	"
C 1316/5	"	Mamaku ..	" ..	"	0.120	
C 1316/6	"	" ..	" ..	"	0.110	
C 1316/7	"	" ..	" ..	Limed ..	0.102	
C 1316/11	"	" ..	" ..	"	0.080	
C 1316/12	"	" ..	" ..	"	0.067	
C 1316/18	"	Litchfield	Grass ..	"	0.080	
D 33/9	Jan.	Te Pu ..	Cocksfoot ..	"	0.112	
D 33/12	"	Mamaku ..	" ..	Unmanured	0.073	
D 33/15	"	" ..	" ..	Control ..	0.080	
D 33/17	"	" ..	" ..	Super and iron	0.120	
D 88/2	"	Te Pu ..	Pasture ..	Slag and iron	0.091	Short, mixed feed.
D 88/3	"	" ..	" ..	Super ..	0.140	
D 88/4	"	" ..	" ..	Lime ..	0.140	
D 88/5	"	" ..	" ..	Unmanured	0.134	
D 88/6	"	Mamaku ..	Cocksfoot ..	Iron ..	0.103	
D 88/13	"	" ..	Green oats ..	Phosphates..	0.098	

Analyses of the samples of hays recently collected from the bush-sick area show an iron content of from 0.08 to 0.13 per cent. of iron (Fe) on the ash.

Dr. J. B. Orr, of the Rowett Research Institute, Aberdeen, gives the following figures for lucerne hay, red-clover hay, and timothy hay:—

	Ash. Per Cent.	Iron Oxide (Fe ₂ O ₃) on Hay. Per Cent.	Iron (Fe) calculated on Ash. Per Cent.
Lucerne ..	5.0	0.17	1.4
Red clover ..	7.1	0.07	0.7
Timothy..	4.9	0.04	0.6

Comparing these figures with those of samples from the bush-sick country given in last month's *Journal* and the grass and hay samples given above, it will be seen that these latter samples are very deficient in iron. With regard to New-Zealand-grown cocksfoot and other grasses, it has also been found that those grown outside the pumice district have, generally speaking, a far higher iron content than those growing on bush-sick lands. Hall, in "The Feeding of Crops and Stock," 1911, p. 4, gives the amount of iron in meadow-grass as 0.007 per cent., or nearly three times the quantity found in Mamaku pasture.

AMOUNT OF FOOD IRON REQUIRED BY ANIMALS.

The amount of food iron, as distinct from medicinal iron, which an animal requires daily must now be considered. By "food iron" is meant the iron present in the natural food of the animal; it has a value greatly differing from that of any iron given in medicinal form, which, although such may be absorbed, the animal is thought not to be able to utilize it in the same way as it does the food iron in the making of blood constituents and other cells. The proof that the animal requires a greater amount of food iron than that present in the bush-sick pasture is the most difficult link to forge in the chain of evidence with which it has been sought to fasten cause to effect.

Sherman ("Chemistry of Food and Nutrition," 1911), in discussing the iron-requirements of the human body, concludes that for the average man under favourable conditions a daily allowance of 10 to 12 milligrams of food iron should suffice. He suggests that the female of the species under certain conditions may require more, and growing children more in proportion to their weight, than does the male.

Dr. Orr states in the "Importance of Mineral Matter in Nutrition" that the best guide to the amounts and proportions of inorganic or mineral foods required by animals is to be found in the composition of the milk-ash of the species. Sheep and pigs double their weight in about the same time, and the mother's milk contains nine times as much iron as human milk; while a calf, which takes four or five times the period to double its weight, receives less than one-quarter of the amount of iron in its milk; and a foal, taking six times the period that a pig takes to double its weight, receives milk which only contains one-ninth of the quantity. Thus the faster a species grows the more iron it is found to receive in its milk food. In practice it is found that the liability of animals to suffer from diseases of malnutrition due to lack of mineral food is greatest in those species that grow fastest. This information is well summarized in the table given by Dr. Orr (modified). (There seems to be the widest discrepancy in the figures given by various authors on the subject of the iron content of milk.)

Species.	Time taken to double Weight. Days.			Proportion of Iron in Milk. (Fe.)
Human	..	..	.. 180	0.00007
Horse	..	..	.. 60	0.00007
Ox	..	..	.. 47	0.00014
Goat	..	..	.. 22	?
Pig	..	..	.. 10 (14)	0.00063
Sheep	..	..	.. 15	0.00079

Abderhalden (*Journal of Physiological Chemistry*, vol. 27, p. 594) gives the time of a sheep as similar to that of a pig. The figure (14) for the pig is given on his authority.

Evidently the food-iron requirements of the different species vary considerably. It seems a fair assumption that a cattle beast would require very much more food iron per unit of body-weight than does the human species. It also seems certain that one cannot admit the possibility of all the food iron being assimilable by the animal. Kellner ("Scientific Feeding of Animals," p. 98) suggests that from two to three times as much mineral food must be given as can be stored in the body. In the case of the mineral constituents—lime and phosphoric acid—it is well known that only about 50 per cent. of these food constituents can be absorbed and retained. It is reasonable to assume that of the total amount present only a part of the food iron can be assimilated.

To make this matter clear one may quote the instance given by McGowan and Crichton in a paper "On the Effect of Deficiency of Iron in the Diet of Pigs" (*Biochemical Journal*, vol. 17, 1923, No. 2). According to these authors, pigs suffered from iron-deficiency when the mothers were fed on the following diet per sow per day :—

	lb.]	Percentage of Iron (Fe).	Iron (Fe). Gram.
Fish-meal	1 $\frac{1}{2}$	..	..
White sharps	2 $\frac{1}{2}$	0.002	0.020
Bran	1 $\frac{1}{4}$	0.030	0.145
Bruised oats	1 $\frac{1}{4}$	0.040	0.226
Potatoes	8	0.010	0.360
Turnips	10	0.007	0.317
Treacle	$\frac{1}{2}$	..	..
Total	..	..	1.068

NOTE.—The iron in fish-meal and treacle is small enough to be negligible.

When plenty of iron oxide was added to this diet the pigs recovered their normal health. It will be seen that an amount of at least 1.068 milligrams of iron per sow per day was consumed.

In the case of the spring and early summer grass, only about 0.0025 per cent. of iron would be present in the pasture, so that 100 lb., the approximate amount that a cow eats daily, would contain 1,134 milligrams of iron. Comparing the relative sizes of the cow and the sow there seems to be evidence here that 1,134 milligrams of total food iron would be insufficient for the cow.

Regarding the requirements of sheep, the milk of the ewe and of the sow is comparable. Both have the same ash content and iron content, and both have a similar rate of growth : hence it is reasonable to assume that the iron requirement may be similar. The ruminant sheep may be more difficult to satisfy in the quality of the food iron ; and whereas iron oxide, cinders, and other inorganic sources of iron may be used in the case of the pig, such may not be assimilable by the sheep, which may require its supply in the form present in vegetable life. Mineral foods given as such are more readily assimilated by pigs than by some domestic ruminants. Experiments in the United States have proved the efficacy of raw mineral phosphate in supplying the bone-making elements when these were deficient in pigs' food, but

mineral phosphates were found to be not effective in the case of cattle in South Africa suffering from phosphate deficiency. For ruminants the mineral foods are no doubt best passed through the pasture by top-dressing or otherwise manuring the natural fodder with mineral fertilizers.

The horse, being of much slower growth than any of the ruminants, taking four times as long as the sheep to double its weight, and having a milk which contains only one ninth the quantity of iron, must have a very low iron-requirement, and this is probably the reason why horses never become bush-sick on the same pasture which produces the disease in sheep and cattle. It is possible also that the horse, with its entirely different system of digestion, has a more economical way of dealing with the small supply of food iron in pasture growing on sick country.

The study of iron as an element in the nutrition of animals has been neglected in a remarkable manner. It seems to have been taken for granted that so little iron is required that it is never deficient, especially in green foods, notwithstanding the well-known fact that plants comprising the pasture vary in composition according to the composition of the soil upon which they are grown and the manuring which has been applied. Indeed, the range of variation in composition of different individuals of the same species of plant under different environment may be greater than that of different species in the same environment. It is known that the mineral elements other than lime and phosphoric acid are required by animals in smaller amounts than are the latter, but the actual requirements *are not even approximately known*. Much work requires to be done to determine the requirements for even such a necessary element as iron. Owing, however, to this lack of exact knowledge regarding the iron-requirement of ruminants one must rely for a decision most largely on a comparison of the chemical composition of the pasture, of the diseased animal, and of the soil with similar samples from normal districts; on the kind of manuring necessary to transform unhealthy land into healthy country; also on certain pathological conditions or symptoms and *post-mortem* appearances which are known to be characteristic of iron starvation; and, finally, on the medicinal treatment by which animals may be restored to perfect health without changing their food. From this evidence, which has been presented, in detail, *one can only arrive at the conclusion that a deficiency of iron in the pasture commonly grown in the affected area is the cause of bush sickness*.

Here the writer would beg the indulgence of the reader to explain a remark regarding sulphur in the article of this series published in the *Journal* for May last (page 303), which has been misunderstood. The writer has been misquoted, and the suggestion that bush sickness is caused by excess of sulphur has been attributed to him, which he now takes the opportunity to repudiate. The paragraph in question was reproduced from the *Journal* for November, 1911, page 398, to explain the formation of pumice. The reference to sulphur is intended to indicate the necessity for the weathering or oxidizing of rock before it can become a suitable medium for plant-growth. So far from excess of sulphur being present in the soil in question, the exact opposite is the case, for some farmed pumice soils contain extremely small

quantities. Sulphur is one of those elements, like iron, essential for the growth of plants and animals, and it is lost from the soil in quantity by leaching. It is, however, also replenished by the rainfall containing sea-spray, which when dried up may be carried long distances inland, calcium sulphate being one of the chief salts of sea-water. Such experiments as have been performed on the sulphur content of New Zealand rain go to show that the amount received per acre is of the same order that experiments in other countries denote is received there. Superphosphate is one of the few artificial manures which contain sulphur as calcium sulphate in quantity, and the influence on crop-growth of this constituent has not yet met with the investigation it deserves. All cruciferous crops, such as turnips, benefit by sulphur, and the superiority of superphosphate over other phosphates for these and other sulphur-demanding crops may be due partly to its sulphur content. Phosphates other than superphosphate, such as Pacific islands phosphate and basic slag, contain so little sulphur that it is negligible. Some of the lower-grade phosphates contain an appreciable amount of calcium sulphate. It is considered that foodstuffs usually contain sufficient sulphur for the animal.

The slow-poison hypothesis was, it is hoped, sufficiently disposed of in the June *Journal*, page 382.

If the matter is one of simple deficiency, why, it may be asked, can the animal not eat more food and so make up for the deficiency in a normal manner, especially since iron is one of those food constituents which may be stored up and are not needed from day to day in balanced ration like protein and carbohydrates? But here the extreme bulkiness of a ruminant's natural fodder comes into play as an adverse factor, even the capacity of an ox being limited. If it requires only one-fifth more iron, can it eat another 20 lb. a day of pasture? And, if it can, will it do so? There may be other factors, such as palatableness, affecting the necessity for eating more. The chances are that an animal getting into an abnormal condition through receiving abnormal food is not likely to be so attracted by it as to eat more—rather will the reverse be the case. One would assume, however, that if the iron-starvation theory be true, wilted grass which has been cut and has lost a considerable portion of the 75 per cent. or more of water which is present in ordinary pasture, if fed to stock, would not only permit of greater consumption and keep them healthy, but would enable them to put on more condition if the fodder were fed in greater quantity. The assimilability of the iron may, of course, be altered by drying the grass, as in haymaking; but, obviously, other things being equal, hay and ensilage should be less likely to cause bush sickness than the green pasture from which it was made, and this aspect is worthy of further investigation.

SOME RECENT WORK BEARING ON IRON DEFICIENCY.

Cotton-seed poisoning or injury is a condition of animals in America of great economic importance. It is attributed to the feeding of cotton-seed meal, and has been variously referred (*Biochemical Journal*, 1924, No. 1) to (1) a poisonous compound of phosphoric acid, (2) an active principle, "gossypol," and (3) dietary deficiency. McGowan and Crichton attributed it, after experimenting with pigs, to iron

deficiency, and call attention to the similarity of the symptoms to those of "wet" beriberi in human beings. They found that iron oxide had a specially beneficial effect in preventing symptoms from arising.

Professor T. B. Wood, in the May, 1924, *Journal of the Ministry of Agriculture*, page 129, states that the importance of the ash constituents of the diet on the growth and development and especially the health of animals has never received the attention it deserves, and in Great Britain has scarcely been touched. Already Dr. Orr and his staff have clearly demonstrated that an inadequate supply of ash constituents produces an immediate and direct effect on the well-being of animals, comparable with the effect of deficiency of vitamins, for which it is frequently mistaken.

In North Britain there exists a malnutrition disease in sheep variously known as "pining," "vinquish," and "daising." This manifests itself as a progressive emaciation when the sheep are grazing on summer pasture, chiefly in certain farms on the Cheviots. If not removed in time the mortality is high. The *post-mortem* examination shows nothing characteristic of disease, the only appearance being one of extreme emaciation and bloodlessness. The only known remedy is to change the sheep to healthy pastures, when they recover. The symptoms shown by living sheep—breathlessness, weakness, bloodlessness, discharge from the eyes which mats the hair of the face, the fleece hard, dry, and staring, and dwindling belly—strongly suggest that pinning and bush sickness are similar if not identical diseases caused by iron starvation. The trouble on the Cheviots has been recognized since 1821, when Hogg, the Ettrick Shepherd, published his classic account of the disease, the cause of which has not yet been discovered. The present writer quotes this instance to show that it takes some time to elucidate obscure nutrition diseases in ruminants, even in highly advanced centres of civilization.

The writer has never entertained for one moment the idea that lack of vitamins could be the cause of bush sickness, although such a theory, suggested by others, would be an easy way out of the difficulty.

THE IRON-STARVATION THEORY.

The writer trusts that with the evidence he has been able to set forth in the continuous series of articles beginning with that in the April number of the *Journal* and ending with this issue, the hypothesis he first publicly suggested in the *Journal* for August, 1912, page 123, may now reasonably be referred to as a theory. The writer there stated: "About eight years ago I made analyses of bush-sick animals' blood, and found it extremely deficient in iron. Subsequent tests confirmed those analyses; this, together with analyses of soils and grasses, hinted that a deficiency of assimilable iron in the food might be the cause of the sickness. This suggested the application of iron compounds to the soil as a possible remedy. When therefore asked to suggest a series of schemes for top-dressing the pastures of the affected country, iron sulphate was recommended by me for two farms situated widely apart. It is significant that of all the substances experimented with, iron sulphate applied alone to pasture has been most successful in enabling

sheep (the animal most susceptible to the sickness) to be kept healthy over a period of eighteen months . . . Should future research establish the 'iron-starvation' hypothesis as a theory, it will open a most interesting field for experiment as to the cheapest method by which the remedy may be applied."

Iron sulphate, however, may be too soluble a substance to be suitable for universal application; it is expensive, and has other drawbacks. One other iron compound that has been tried as a dressing for soils is spent oxide from gasworks, containing nitrogen and sulphur compounds. This had a much better effect in producing pasture which enabled sheep to be kept healthy, but the general effect was to decrease the food value of the pasture owing to crowding out of the clovers, which eventually disappeared, probably due to the nitrogenous compounds. Parapara iron, an hydrated oxide, is suggested in the above-quoted *Journal* article (August, 1912) as a source of the needful iron. Being insoluble in pure water, it is not likely to affect the botanical composition of the pasture injuriously, and it might be found to give good results in conjunction with phosphatic manures. Ever since this date (1912) iron deficiency has been the guiding light by which it has been sought to further elucidate the correct treatment of bush-sick lands and animals, a light which has never failed to penetrate obscurity when it seemed most dense.

It is now advisable that the misleading term "bush sickness" should disappear, and be supplanted by the name "iron starvation." The adoption of such a name would do much to bring, if not correct treatment, at least adequate general recognition of the cause of this diet-deficiency disease.

The methods by which iron-hungry pumice lands should be improved are: (1) Appropriate mineral manuring; (2) green-manuring, and, where practicable, application of other organic manures; (3) compaction by rolling; (4) application, where practicable, of any available deposit of greater clay or iron content. The mineral manuring should aim at supplying iron and phosphates. Basic slag, which contains a considerable amount of iron (from 15 to 23 per cent. of oxides), is alkaline, and not so efficacious as when applied with an equal amount of superphosphate. This mixed dressing is found to give the best results on Mamaku pasture. Potash is already present in quantity in most pumice soils. Green-manuring should be practised, and, where available, any organic manures (stable, pig, or cow manure) which will fill up the interstices in this too porous soil and assist in the decomposition of the pumice should be applied. Rolling will consolidate the soil and decrease the exceptional porosity. Other available deposits, such as eruption mud, crushed rhyolitic tuff, &c., containing more iron and fine particles than pumice, will assist in the general amelioration. Topographical surveys, followed by soil surveys, will enable lands of varying quality to be classified and mapped.

CONCLUSIONS.

Bush sickness is a progressive anæmia affecting ruminants only, leading to the death of the animals if they are not removed to healthy country.

Chemical analyses of the soils, pasture plants, and animal specimens from affected country show a deficiency of iron compared with what may be found in normal specimens from healthy country.

It was only logical to assume that the deficiency of iron in the animal is due to a deficiency of iron in the pasture brought about by the low amount present in available condition in the soil. To make certain, however, that this is the case, it was first necessary to eliminate all other possible causes of anæmia, since this condition might be brought about by chronic poisoning. Lengthy investigation has not revealed the presence of any poisonous element or compound. It was also necessary to test the hypothesis by all sorts of feeding-experiments, with various medicinal treatments as a preventive and as a cure. As it takes from six to twelve months for cattle to show signs of bush sickness, this testing has been a matter of years rather than of months. The original hypothesis, therefore, is now offered as a workable theory which its author has no doubt is absolutely sound.

There exist at least three other areas outside New Zealand where a similar disease exists, none of which has been traced to its cause. One of these, in North Britain, has been known for the past one hundred years. The New Zealand disease is the first occasion, so far as one can learn, of progressive anæmia in ruminants being credited to lack of iron in the green pasture. The importance of the matter to New Zealand is shown by the fact that there is probably an aggregate of over a million acres affected, which, could an economic cure be discovered, would be highly suitable for close settlement as dairy farms. The first step naturally being to discover the cause, the writer claims that this has now been demonstrated. It remains but to determine an effective and economic remedy, and experiments are being pushed forward in this direction.

NOTE.—The writer has much pleasure in acknowledging the willing and efficient help which has been rendered at all times in field and laboratory by his assistants, Messrs. F. T. Leighton, L. D. Foster, and R. E. Grimmett, M.Sc.

Wool-packs and Vegetable Fibres.—At its meeting held last month the Board of Agriculture considered a letter from the Bradford Chamber of Commerce pointing out the loss sustained owing to fibres of jute from the wool-packs becoming mixed with the wool. Such fibres could not be detected until the yarns were dyed, and the cost of picking them out of the cloth was a very considerable expense. It was suggested by the Chamber that paper linings should be used, to be partially paid for by the buyer of the wool. The Board came to the conclusion that if the inside of the pack was singed, as was the case with the outside, it might be a remedy, and a trial could be made by reversing the sides of the wool-pack. The Director-General of Agriculture agreed to procure from the Mataura Paper-mills a paper lining to experiment with, and for the purpose of ascertaining whether the suggestion was feasible in practice and cost. It was also reported that experiments were being made to manufacture a pack woven from wool, so as to entirely obviate the danger from jute-fibre, but this proposal had not yet reached the practical stage.

THE GRASSLANDS OF NEW ZEALAND.

REGRASSING EXPERIMENTS ON DETERIORATED HILL COUNTRY IN WHANGAMOMONA COUNTY.

E. BRUCE LEVY, Agrostologist, Biological Laboratory, Wellington.

IN the *Journal* for September, 1923, the writer described the main features of the Taranaki back country and the local problem of grassland deterioration. The district in question is broadly typical of the hilly bush lands of the North Island, particularly of the great mass of broken back country stretching from Wanganui to Raglan. Much of the formerly forest-clad areas of this region has reverted to fern and scrub growth, and the process is tending to increase rather than diminish. In the aggregate, hundreds of thousands of acres felled and grassed at a cost of several pounds per acre now carry practically no grass at all. The chief factor in this result has been lack of knowledge—a lack which can be made good only by systematic research, combined with analysis and pooling of the best practical experience of those settlers who have achieved success in grassing their holdings and maintaining the pasture.]

This year a definite beginning has been made by the Department of Agriculture with regrassing experiments in Whangamomona County along the lines indicated, and the purpose of the present article is to record the scheme, together with its underlying principles. The experiments are co-operative, in that the farmer supplies the land and does most of the work, while the Department supplies all the seed necessary, supervises the sowing, and records results. The experimental areas were selected largely by the farmers themselves. In each district a small committee was set up, in most cases this being a sub-committee of the Settlers' Association of the district. The writer is intimately connected with the experiments, and is working in conjunction with Messrs. J. W. Deem and A. J. Glasson, district officers of the Fields Division, under the general guidance of the Director of the Division, Mr. A. H. Cockayne.

In these experiments the establishment of a close and continuous sward of grasses and clovers is the first consideration, for it is felt that without a close cover it is not possible to prevent weed-invasion, nor is it possible without the grass sward to successfully maintain stock on the area, and it is the stock—particularly cattle—which acts as the great clearing implement for the secondary growth of the hill country. By forcing cattle on to fern and other secondary growth it may be broken down, but unless the ground bared of the secondary growth becomes occupied by a grass sward it will become immediately open to invasion by herb-like weeds such as catsear, selfheal, cudweed, rib-grass, plantain, pipiriri, &c., or by hard fern. Again, even though much may be done by top-dressing with artificial manures, feeding out hay, and so forth, it is felt that if the manure (artificial fertilizer or stock manure) is applied to open grassland or on weeds a large proportion of the manure is wasted; whereas if there is a close and continuous grass and clover sward upon which the manure is used every available ounce of the latter is used by the



FIG. 1. BRACKEN-FERN SLOPE ON PROPERTY OF MR. FRED. COXHEAD, TAHORA, BEFORE BURNING AND SOWING.

The plots extend from the road-fence to the brow of the hill.

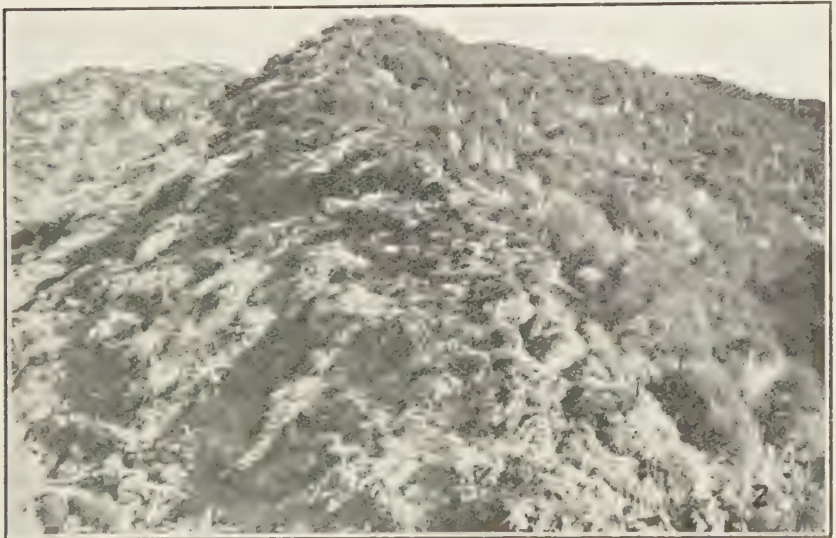


FIG. 2. KNOLL COVERED WITH TALL MANUKA AND BRACKEN-FERN, WITH WINE-BERRY-FUCHSIA GULLIES, ON PROPERTY OF MR. CLAUDE CARTER, TAHORA.

The slope (shady side on left) was winter-felled, and the greatest difficulty was found in getting a burn. The slope on the right, mainly manuka, was not felled until a few weeks before burning; on this side a clean hot burn was secured. The plots take in the whole of this knoll.

[Photos by E. Bruce Levy.

plants which it is desired to stimulate; further, there is not nearly the same loss through actual washing off the surface.

Nearly all the common grasses and clovers known to New Zealand agriculture at the present time are being in one way or another tested in the experiments. Due consideration has been given to those important principles enunciated in the writer's article published in the May issue of the *Journal* (pages 294-300), a synopsis of which is worth repeating here. The common grasses and clovers may be divided up into groups. Each group has a standard of soil-fertility that must be maintained in order that the species of that group may thrive. The first-class "better" grasses and clovers demand the highest state of soil-fertility. These grasses persist and thrive just so long as they are fed up to their full capacity. When the fertility of the soil falls below the standard of the first-class grasses and clovers the yield of these species falls off, and the plants dwindle and become small and stunted. This means an opening-up of the turf, and then, if there are none of the lower-fertility-demanding grasses sown to take up the running, the area will undoubtedly run to weeds. Poorer grasses or weeds spreading in a pasture indicate clearly that the fertility has fallen below the standard of the better grasses. When the fertility falls the better grasses do not die out entirely, but remain small and stunted—mere vestiges persisting among the stronger and ranker growth of the lower-fertility-demanding grasses. While there is life in these vestiges of the better grasses there is hope for the improvement of that sward. Immediately the fertility of such a soil is raised to the standard of the better grasses these soon spring into vigorous growth and begin to oust the poorer grasses. To act as pioneers in the processes necessary to effect consolidation of the soil surface, or to deal with strong secondary growth and to take up the running should the soil-fertility fall, the poorer grasses and clovers are essential.

In the experiments laid down most mixtures contain grasses and clovers that in the aggregate will thrive over a wide range of soils and conditions, so that if it is not possible to keep the fertility up to the standard of the better grasses and clovers there will be some species that will thrive and form some sort of a grass sward until such time as it is possible to raise the fertility of that soil. The pioneering elements have not been lost sight of. Some quickly establishing species have been put into the mixtures, not with the hope of retaining these species as permanent elements of the pasture, but to afford some rapid feed so that plenty of stock may be kept on the area in the spring-time, when fern and other secondary growth is making headway. There are included also those plants that will penetrate into the secondary growth and will persist there, producing feed that will induce stock on to these parts during the late autumn and winter. In one series shown in Table 1 (mixtures Nos. 1-4) the basis of the mixture is the same throughout, but the amounts of the finer, turf-forming grasses* vary. The endeavour is to get plots side by side containing respectively a large proportion of danthonia, brown-top, paspalum, and Chewings fescue. It is felt that one or more of these four low-fertility-demanding grasses must be added to all mixtures

* For a definition of the term "finer" grasses as used in these articles see note at foot of page 290 in *Journal* for May last.

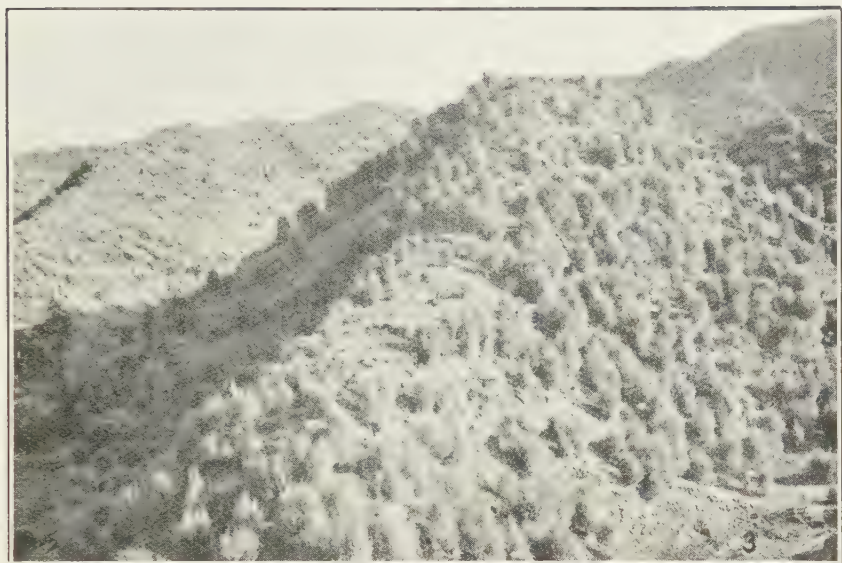


FIG. 3. KNOLL CARRYING SPARSE MANUKA AND SOMEWHAT STUNTED BRACKEN-FERN ON PROPERTY OF MR. OSTLER, KOHURATAHI.

Photographed previous to the manuka being cut. On the left is a dark mossy slope. The plots extend over the hill-crest from gully to gully.



FIG. 4. SLOPE CONSISTING OF HARD FERN AND WEAK TURF ON PROPERTY OF MR. RAUGHAN, KOHURATAHI.

The plots extend out $4\frac{1}{2}$ chains from the fence on the right, and occupy nearly the whole of the area shown in photo.

[Photos by E. Bruce Levy.

of secondary-scrub burns, but just which one or ones are the best to use can be ascertained only by definite experiment. Finer grasses dominant in the mixture come in for a good trial (mixture No. 5). The disadvantage of including finer grasses only, however, lies in the fact that there is not the same chance of improvement, as far as quality of the pasture is concerned, if at a later date the fertility of that soil can be raised. The seed of the finer grasses also is expensive. It will be interesting, however, to see what a heavy sowing of these grasses results in. In mixture No. 6 no rye-grass is included, and the finer grasses are reduced to about what one would consider a normal sowing of these. Mixture No. 7 is high in clovers, with a normal seeding of finer grasses. In mixture No. 8 twenty-nine different kinds of plants are used—practically all the common ones used in grasslands anywhere in New Zealand. It will be extremely interesting to see which kinds out of all these will ultimately predominate as time goes on. In mixture No. 9 *paspalum*, *Chewings fescue*, and *Poa pratensis* have been eliminated altogether, and reliance placed on brown-top and *danthonia* as far as the finer grasses are concerned. In the Whangamomona district a certain amount of *paspalum* is already established, and there is no doubt that, could a better winter-feed provision be secured from these pastures, this grass would increase greatly in favour. By sowing mixture No. 10 on top of the already existing *paspalum* pasture it is hoped to introduce certain companion winter-growing plants. Subterranean clover is of outstanding promise in this respect, and *Lotus hispidus* and crested dogstail are certainly highly desirable to have associated with the *paspalum*. Mixtures No. 11 and No. 12 are sown on primary-forest burn, mixture No. 11 being used on the lower and better country and No. 12 on the upper ridge country. These two mixtures are heavy, and are not intended as type mixtures for this class of country. On the rest of the burn adjacent to these plots the occupiers, Messrs. Murphy Bros., have sown a good general mixture, and in our tests certain additional species have been included—namely, *paspalum*, meadow-foxtail, *Poa trivialis*, and meadow-fescue. The trial is really a test of these additional species, which latter, being put in over and above the good general mixture, make the seeding appear very heavy. In most cases the mixtures as set out in Table 1 are too expensive, particularly so where an excess of certain of the finer turf-forming grasses has been included. Probably none of the mixtures as here set out will be the final ones adopted, but the cheapest and most efficacious mixtures will be drawn up for the different types of country from results secured by an analysis of the turfs produced by each seeding.

In setting out these experiments as many types of secondary growth and as many different aspects of slope, &c., as possible were selected for inclusion. The type of the stock carried and the method of farming practised also vary on the different farms where the experiments are being conducted. An examination of results of the same mixtures under different types of stocking and farm-management will therefore be made, and this will be of great interest.

The experiments include the following: (1) Felling, burning, and sowing of dense manuka; (2) felling, burning, and sowing of scattered manuka, fern, &c.; (3) burning and sowing of bracken-fern; (4) burning



FIG. 5. HARD-FERN AND MANUKA AREA ON PROPERTY OF MR. BOTTOMLEY, WHANGAMOMONA.

Portion of the hard-fern face on left was grubbed before sowing. The plots take in all the middle distance beyond railway-line.



FIG. 6. BRACKEN-FERN SLOPE ON PROPERTY OF MR. J. MCCLUGGAGE, WHANGAMOMONA; WINEBERRY, WHEKI, TUTU, ETC., IN GULLIES.

The plots occupy nearly the whole area shown, and run from the gully below to the hill-crest, being parallel to fence on right.

[Photos by E. Bruce Levy,

and sowing of hard fern and patches of water-fern; (5) surface-sowing of weak pasture turfs to see if such may be improved by introduction of additional species; (6) surface-sowing of piripiri-infested areas; (7) felling, burning, and sowing of wineberry, fuchsia, &c.; (8) felling, burning, and sowing of primary forest.

In each place and for most classes of growth blocks of from 4 to 7 acres in area were sown. Each of these areas is divided up into 1-acre plots, and on each 1-acre plot on any one area a different grass-seed mixture is sown. From this it will be seen that the experiments are on a practical field scale; none is being especially fenced off, so that they will take their chance with the rest of the paddocks as far as stocking and management are concerned. The following table gives the different seed-mixtures included in the trials:—

Table 1.—*Experimental Grass-seed Mixtures sown, Whangamomona County.*

Mixture.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Cocksfoot ..	8	8	8	8	..	10	..	4	8	..	8	8
Crested dogtail ..	4	4	4	4	6	6	6	2	6	6	4	6
Perennial rye-grass ..	6	6	6	6	4	..	4	4	..	..	6	6
Italian rye-grass ..	2	2	2	2	6	..	..	2	..	..	2	2
Poa pratensis ..	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	..	..	1	..	..	$\frac{1}{2}$	$\frac{1}{2}$
Brown-top ..	$\frac{1}{4}$	2	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	1	1	$\frac{1}{4}$	2	..	1	2
Danthonia pilosa ..	8	1	1	1	8	4	3	1	4	..	3	6
Paspalum ..	2	2	2	8	2	2	2	1	..	..	4	4
Chewings fescue ..	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	..	..	$\frac{1}{2}$	..	..	..	1
White clover ..	1	1	1	1	1	$\frac{1}{2}$	2	$\frac{1}{2}$	1	1	$\frac{1}{2}$	$\frac{1}{2}$
Lotus major ..	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	$\frac{1}{2}$	1	1	$\frac{1}{2}$	$\frac{1}{2}$
Lotus hispidus ..	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	$\frac{1}{2}$	1	1	$\frac{1}{2}$	$\frac{1}{2}$
Red clover ..	1	1	1	1	..	..	2	$\frac{1}{2}$	$\frac{1}{2}$	1	2	1
Subterranean clover ..	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	$\frac{1}{2}$	$\frac{1}{2}$	1	$\frac{1}{2}$	$\frac{1}{2}$
Yarrow ..	$\frac{3}{2}$	$\frac{3}{2}$	$\frac{3}{2}$	$\frac{3}{2}$	$\frac{3}{2}$	$\frac{3}{2}$	$\frac{3}{2}$	$\frac{3}{2}$	$\frac{3}{2}$	..	..	$\frac{1}{6}$
Meadow-foxtail ..	..	..	..	..	..	..	..	2	..	..	4	..
Poa trivialis ..	..	..	..	..	..	..	..	$\frac{1}{4}$	$\frac{1}{2}$	..	1	..
Timothy ..	..	..	..	..	..	..	..	1	2	..	2	2
Tall fescue ..	..	..	..	..	..	..	..	1	..	..	..	..
Tall oat-grass ..	..	..	..	..	..	..	..	2	..	..	..	..
Meadow-fescue ..	..	..	..	..	..	..	..	2	..	..	6	..
English trefoil ..	..	..	..	..	..	..	..	$\frac{1}{2}$	..	..	..	..
Lotus corniculatus ..	..	..	..	..	..	..	..	$\frac{1}{2}$	..	..	..	..
Strawberry clover ..	..	..	..	..	..	..	..	$\frac{1}{2}$	..	..	..	..
Crimson clover ..	..	..	..	..	..	..	..	1	..	..	..	..
Alsike ..	..	..	..	..	..	..	..	1	..	..	..	..
Red-top ..	..	..	..	..	..	..	..	$\frac{1}{4}$	..	..	..	..
Rape ..	..	..	..	..	..	..	..	$\frac{1}{4}$	..	..	1	1
Turnip ..	..	..	..	..	..	..	..	$\frac{1}{4}$	..	..	..	..
Total per acre ..	$34\frac{3}{4}$	$20\frac{1}{2}$	$31\frac{1}{4}$	$33\frac{3}{4}$	34	25	23	$31\frac{1}{4}$	$20\frac{1}{2}$	11	$46\frac{1}{2}$	$41\frac{1}{2}$

($\frac{1}{2}$ lb. = $\frac{1}{2}$ oz.; $\frac{1}{4}$ lb. = 1 oz.; $\frac{1}{8}$ lb. = 2 oz.)

No. 1. General mixture—danthonia dominant. No. 2. General mixture—brown-top dominant. No. 3. General mixture—Chewings fescue dominant. No. 4. General mixture—paspalum dominant. No. 5. Finer grasses dominant, to succeed temporary rye-grass. No. 6. General mixture, including finer grasses without rye-grass. No. 7. Finer grasses, and heavy in clovers. No. 8. Mixture containing most common grasses and clovers. No. 9. General mixture with small number of species of finer grasses. No. 10. For sowing on established paspalum. No. 11. Primary-bush-burn mixture, testing additional species. No. 12. Primary-bush-burn mixture, with large quantity of finer grasses.



FIG. 7. HARD-FERN SLOPE ON SIDE OF GULLY OPPOSITE AREA SHOWN IN FIG. 6.

The plots occupy most of the area shown, and extend from the gully below up to the hill-crest.



FIG. 8. PRIMARY-FOREST BURN ON PROPERTY OF MURPHY BROS., AOTUHIA.

Mr. W. Murphy is shown sowing the experimental area.

{Photos by E. Bruce Levy.

Table 2.—Location and Description of Areas sown

Area on Property of	Type of Country.	Mixtures used. (See Table 1.)	Date sown.	Remarks.
F. Coxhead, Tahora .. (Fig. 1)	Patchy bracken-fern; sunny aspect	1, 2, 3, 4, 5	7/3/24	Fairly good burn, considering patchy nature of fern.
C. Carter, Tahora .. (Fig. 2)	Tall, dense manuka, and odd gullies with fuchsia, wineberry, and fern	1, 2, 3, 4, 5, 6	6/3/24	Hard, clean burn on dense manuka slope, but poor burn on shady wineberry slope and gullies.
Wilson and Son, Putikitunga Rd., Kohuratahi	Hard fern mainly; patches of water-fern and open weak grass turf	1, 2, 3, 4, 5, 7, 8	24/3/24	Clean hard burn; burnt early in February; very little ash remaining when sown.
J. Ostler, Kohuratahi .. (Fig. 3)	Stunted bracken and scattered manuka; weak turf, mossy slope, and wineberry gully	1, 2, 4, 5, 7	22/3/24	Fair burn on bracken slope, but poor on shady slope and wineberry gully.
J. Ostler, Kohuratahi ..	Established paspalum ..	10	26/3/24	Attempt to introduce winter-feed-producing plants.
J. Raughan, Kohuratahi (Fig. 4)	Hard fern mainly; weak, open turf; some water-fern and manuka	1, 2, 3, 4, 5, 6	14/3/24	Fairly good burn, but not hard on ground surface to scorch rhizome of fern.
A. Bottomley, Whangamomona (Fig. 5)	Hard fern and manuka; weak, open turf	1, 5, 7, 9	21/3/24	Fairly clean burn; small area of hard fern grubbed.
J. McCluggage, Whangamomona (Fig. 6)	Bracken-fern; steep slope; sunny aspect, with shady gullies	1, 2, 4, 5, 8	5/3/24	Fairly good burn, but not hard; hard-fern patches not burnt to rhizome.
J. McCluggage, Whangamomona (Fig. 7)	Patches of hard fern; weak turf; shady aspect	1, 2, 3, 5, 6	7/3/24	Patches not burnt clean to edge, and burn too light to kill surface rhizome.
A. Coxhead, Whangamomona	Manuka slopes; hard-fern patches and wineberry gullies	1, 2, 4, 5, 7, 8, 9	22/3/24	Fairly good burn; greater portion burnt early in February; 1 acre burnt 4/3/24 and sown 5/3/24
Murphy Bros., Aotubia (Fig. 8)	Primary - forest burn; ridges, kamahi dominant; lower slopes, tawa, rimu, and pukatea mainly	11, 12	10/3/24	Burnt before Christmas; 2½ acres of each mixture sown; good clean burn.
R. McCluggage, Pohokura	Tall bracken-fern and manuka; wheki and other scrub growth	1, 2, 4, 8	26/3/24	Fairly good burn, excepting round edges of area.
A. McCluggage, Pohokura	Established paspalum and open cocksfoot turf	10	24/3/24	Attempt to improve winter feeding of paspalum pasture.
E. J. Wilde, Pohokura ..	Stunted, half-crushed-out bracken mainly; manuka spur and hard-fern patches	1, 2, 3, 4, 5, 7, 8	20/3/24	Difficult to burn, excepting manuka slope, which burnt hard and clean.
H. Barwick, Te Wera ..	Manuka and hard-fern patches; open turf and piripiri	1, 2, 4, 7, 9	19/3/24	Fairly good burn, excepting some hard-fern patches.
A. J. Stonewigg, Te Wera	Manuka, hard fern, and bracken; tutu gullies	1, 2, 5, 6, 8	27/3/24	Mostly patch-burning on a difficult slope.
C. V. Kidd, Strathmore (Fig. 9)	Tall, heavy manuka and bracken-fern in parts	1, 2, 3, 4, 5, 8	24/3/24	A splendid burn; on manuka portion clean and hard.

NOTE.—Certain of the above dates are only approximate. On some areas the sowings extended over a period of from two to six days.

The experimental plots in the aggregate cover 84 acres of hill land, and the areas sown are representative of most soil-types and most forms of secondary growth that occur in the Taranaki back country. The trials will be of value not only to the immediate neighbourhood, for the results will be applicable to almost the whole of the broken bush country of the North Island, and any plots put down in other parts will be more or less demonstrational of results secured in the Whangamomona County.

Owing to the wet season experienced it was found impossible to burn at all well the wineberry-fuchsia gullies, nor any large area of

water-fern. Intense burns of hard fern so that the surface rhizomes were scorched and killed were difficult to get, and in most cases there is bound to be a fairly rapid return of the hard-fern growth. However, it is hoped that the shade-enduring and pioneering plants included in the mixtures will come on and thrive among the hard fern, providing a sufficiency of feed there to induce stock to graze and tread upon the patches. The bracken-fern burnt well on the whole, but throughout the time of burning the lack of wind rendered repeated torching of the clumps necessary. It would appear that too hard a burning of bracken-fern areas is not advisable, and that if an inch or so of dead fronds could be left unburnt on the ground this would ensure a much better



FIG. 9. SOWING MANUKA BURN ON MESSRS. KIDD AND POPE'S PROPERTY AT STRATHMORE.

This area was cut only a few weeks before burning. Portion only of the area is shown in photo.

[Photo by J. M. Smith.]

establishment of the seed ; there would not be the same danger of sun-burning of the young seedlings, nor such a loss from bird depredations. If too much dead frond is left, however, the seedlings will be exhausted before they can get their leaves to the light. In several instances we found in burning that a light fire took nearly everything on the drier portions, but left a big mass of dead fronds, often 1 ft. thick, in the damper hollows or on the shady slopes. These latter patches after two or three days of fine weather could readily be fired again, and then an excellent seed-bed was secured over the whole area.

In the burning of the manuka fierce hot fires were secured, particularly so on those slopes where the manuka had been cut only three or four weeks before firing. On two areas the last of the manuka was

not cut until about a week before the fire. These areas burnt splendidly even after not more than three days of fine weather. On the other hand, on those areas where the manuka had been cut in winter or early spring, burning was often difficult, especially so where the manuka was sparse. Growth of young fern and grass got among it, and then these areas required about ten days of fine weather before they were dry enough to carry a fire well. Where the manuka was dense, so that a complete cover of fallen manuka was formed on the ground, there was no fern or other growth coming through, and these areas burnt well after a few days of fine weather. It would certainly appear that sparse manuka should not be winter-cut, but should be left to within a few weeks of burning-time. The thicker, denser manuka slopes, however, may quite safely be cut in the winter, although these burn even more readily when felled only three or four weeks before firing. The winter-time, however, generally affords the greater opportunities for cutting manuka, but during that time felling should be confined to the denser areas. Wineberry, tutu, fuchsia, and lacebark gullies should not be cut in the winter where wet summers are experienced. Even where these growths were thrown into heaps after being felled the greatest difficulty was experienced in getting a burn. Water-fern and other young growth comes away through the felled scrub during the spring, and it is this growth which prevents firing. Again, all the leaves fall off, leaving only bare sticks, and, unless one gets a dry spell with good wind, burning is out of the question.

In Whangamomona County fairly good burns of secondary growth may frequently be secured early in the summer, and many settlers seize upon this opportunity to burn. In the case of hard fern and water-fern, and felled wineberry, fuchsia, &c., early summer burning after a good dry spell would seem advisable, but the grass-seed should not be sown immediately after the burn, because of the great danger of sun-burning of the young seedlings. Early summer burns of manuka and bracken-fern are not advisable, for felled manuka (and manuka should never be burnt standing) can well be burnt later when conditions are more suitable for the establishment of the grass-seed sown. It must be remembered that a freshly burnt area affords a better chance of seed-establishment than does an area that has been burnt for some time and the ash washed off or consolidated. Summer burning of bracken-fern before the end of February is not advisable, because of the speedy return of the bracken-fern after the fire. Bracken-fern should be burnt as late in the autumn as possible, so that there may be no return of the bracken growth until the following spring. This gives the young grass a very much better chance of becoming established, and there is no need for the "heart" to be eaten out of the young grass, which is very liable to happen if any reappearing young fern coming away after the burn in the autumn has to be dealt with.

In these trial sowings a great many different kinds of seed-beds have been secured, and this point of establishment of the seed sown will be dealt with in a later article when giving a progress report of the experiments.

New Rabbit District.—The Harapepe Rabbit District (Raglan County) has been constituted for the purpose of Part III of the Rabbit Nuisance Act.

PLANT-SELECTION AND SEED-PRODUCTION.

WORK AT THE MOA SEED FARM.

(Continued.)

J. W. HADFIELD, Manager, Moa Seed Farm, Dumbarton, Central Otago.

II. SEED-PRODUCTION.

IN the first part of this article, published in last month's *Journal*, the writer outlined methods adopted on the Moa Seed Farm in raising stock seed, and his present intention is to briefly discuss the methods adopted in the production of commercial seed.

The importance of plant-selection to the seed-grower has already been indicated, and it can be readily appreciated that the work requires a fair amount of skill and patience. On the other hand, the production of commercial seed is work which no farmer need hesitate to undertake, provided he is painstaking in his methods. Ethics, also, have an important bearing upon seed-growing, since in no other type of farming does the purchaser have to depend so completely upon the word of the grower. Germination and purity tests and inspection of the seed will not reveal whether the grower has taken the necessary precautions against cross-pollination with another variety, nor whether he conscientiously culled his roots when digging. The purity of the variety, and its type and quality, can only be determined after some of the seed is grown, and as probably all the seed will by then have been distributed it is generally too late to remedy any mistake. The farmer may therefore find great difficulty in producing stock seed, without which quality and type will deteriorate, or, as an alternative, he will be faced with the necessity of culling heavily each year if a reasonably high standard is to be maintained. This difficulty is overcome by the seedsman raising the stock seed and distributing it to his growers, who produce on contract.

The great obstacle to extensive seed-growing in this country, and one which probably overshadows all others, is the cost of production, the main item, of course, being labour. On the other hand, it may be considered that certain parts of the Dominion are very well suited for seed-production, and with reliable information and labour-saving methods and appliances the future prospects are decidedly bright. The cost of production on this Moa Farm* has been relatively high, to which further reference will be made; but our seed has always been of very fine appearance and high germination, and our yields considerably higher than those reported as being the average of the Californian seed crops.

It is not intended to here deal with clover, lucerne, grasses, peas, and cereals, all of which are grown commercially for seed purposes both on the Moa Farm and also throughout New Zealand; attention will be confined to vegetable and root seeds which are grown on this Farm, but are not commonly grown by farmers.

There is practically no literature available dealing with seed-production, and it is difficult to get reliable information regarding methods adopted in the large seed-producing areas of Europe, Asia, and America.

The explanation lies—in part, at least—in the fact of the relatively few growers compared with the number of consumers. This is better appreciated when it is pointed out that one man, were he to get the assistance of a few boys at harvest-time, would have no difficulty in producing sufficient seed to sow 2,000 acres of parsnips. Carrot, lettuce, radish, onion, cabbage, turnip, celery, and flower seeds are more or less parallel cases. The growing of these seeds is in the hands of a few, and a large number of these growers assess the knowledge they have as part of their stock-in-trade, and, rightly or wrongly, refuse to part with it. The methods advocated here are almost entirely the outcome of our own experience during the last four years, though methods adopted in other countries will sometimes be referred to.

CULLING.

Each individual plant possesses certain characteristics which are the result of two influences brought to bear upon it. The first is the effect of environment, and the second is heredity. Particularly in roots the shape and quality are largely influenced by soil and season, the manure applied, and the care and cultivation given to the crop. These influences are temporary, and have to be repeated to produce the same effect upon a succeeding crop. They form, in fact, part of the environment of the plant, resulting in certain characteristics which are not transmitted by inheritance. On the other hand, each plant is of a definitely constituted type, possessing merits and demerits predetermined by inheritance, and these characteristics may be transmitted. An equal increase in yield may be brought about either by manuring or by breeding. The one costs little, but is a very temporary and sometimes erratic increase, whereas the initial cost of raising a high-yielding strain may be greater, but it is of infinitely greater value.

When, therefore, a malformed root is dug up it is really not known whether the defect is due to inheritance or to environment, though a very good guess can often be made. Nevertheless, the root has to be discarded, for though the defect may after all be due to its environment, and it may produce quite satisfactory descendants, yet there is the possibility of the defect having been inherited, and the probability of it being transmitted. For this reason, if for no other, roots should be given the most favourable conditions for development, and this applies particularly to roots grown for the production of stock seed. Favourable conditions will largely mitigate the environmental influences overshadowing those of heredity. Great discrimination should be observed in culling, and a root should, to a large extent, be judged by comparison with those around. Thus, a small mangold, if it comes from poor soil, and is reasonably large in comparison with those around, should be retained in preference to one perhaps much larger but growing in a richer piece of land and relatively poorer in comparison with its neighbours.

In cross-pollinated plants, such as most biennial roots, considerable improvement is effected by continued selection within a strain raised from a single-plant selection; but with self-fertilized plants, as, for example, garden peas, once a pure line has been isolated it is not likely that continued selection will result in further improvement.



FIG. 1. VIEW OF HOMESTEAD SECTION AT MOA SEED FARM, WITH TEVIOT STATION IN THE DISTANCE.

In foreground—from left to right—are one-acre plots of lettuce (commencing to shoot), French breakfast radish (in full flower), and scarlet runner beans. On the left of these are the trial plots.

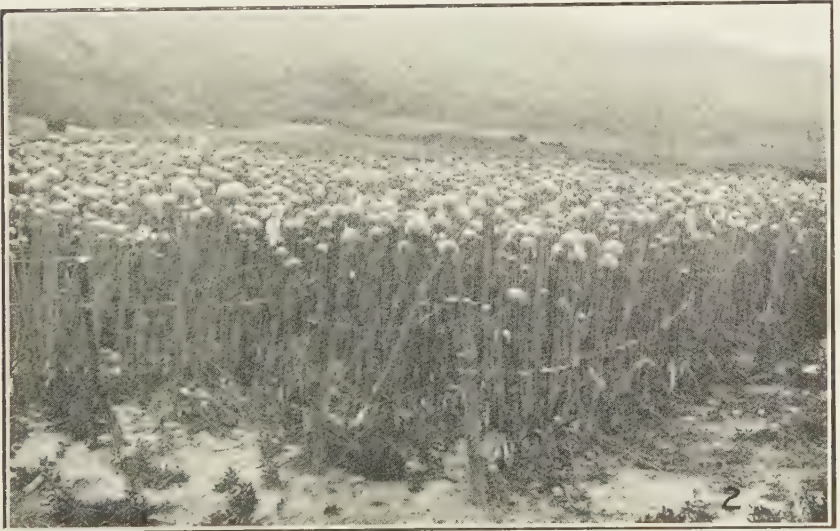


FIG. 2. ONION-SEED CROP IN FULL FLOWER.

SOWING AND CULTIVATION.

The sowing of root crops at the Moa Farm commences with onion-seed about August, and ends with beet-root about October. With the exception of the onion crop there is not much to be gained by early sowing, as most varieties have ample time to sufficiently develop before being dug in the winter, and late sowing enables one or two crops of weeds to be eradicated. Land for carrots and parsnips should be light and friable. Heavy land that is poorly drained causes a large number of malformed roots in carrots, while, on the other hand, we find that the heavier soil produces better beet-root and globe mangolds, both in roots and seed.

To facilitate thinning we sow on a ridge made with a disk ridger, in rows 27 in. apart. On friable and silty land the ridger does excellent work, but on heavy land the tendency is for the hard lumps on the surface to be thrown to the centre of the ridge, and the seed when sown drops in among these and germinates irregularly. We overcome this difficulty to some extent by dragging a light clod-crusher behind the ridger. This serves the double purpose of pulverizing the soil and levelling off the top of the ridge. A high ridge is not desirable in any variety of carrot which produces its root entirely in the ground. If too high, thinning exposes too large a portion of the young root, resulting in contracted necks and otherwise malformed roots. Seed is sown on the top of the ridge with a small hand seed-drill.

We use no fertilizers on the farm except for potatoes and peas, and it is only in moist seasons that even these crops show much benefit from this treatment. We have carried out many trials, leaving strips unmanured or manuring strips of cereals, also top-dressing lucerne and clovers, but have never noticed any difference.*

Thinning we perform as much as possible by hand, and as little as possible with the hoe. The objective is the production of the largest possible number of medium-sized and perfectly shaped roots. Mangold and beet are thinned almost exclusively with the hoe, but undoubtedly the most satisfactory and perhaps even the most economical seed roots are obtained by hand thinning.

HARVESTING ROOTS.

With the completion of threshing and seed-cleaning operations in March, the onion crop receives first attention. This is followed by potato-digging, which we generally complete before the end of May. As severe frosts may now be experienced the beet-root crop has next attention, followed by mangold, carrot, and parsnip, in the order indicated. In each case shallow-rooted varieties receive preference, as these are far more liable to frost injury than those having long roots reaching down below the frozen ground.

During the winter of 1923 continued wet weather prevented the harvesting of roots until well into June. Following this we experienced several weeks of cold weather, registering as much as 20 degrees Fahrenheit of frost. The ground was frozen for some weeks, and the shallow roots were lifted out of the soil. Freezing ruptures the cell structure of the root, and also results in a considerable loss of moisture. This may explain why roots extending well down into the ground seemed able

* Readers interested in this aspect may be referred to an article on the mica-chist soils of Central Otago, &c., by B. C. Aston, published in the *Journal* for June, 1923.

to draw upon a supply of moisture, and more readily overcome the effects of freezing. Whatever the explanation may be, the following list of approximate losses which we experienced during the 1923 winter is interesting in this connection, indicating that the shallow-rooted crops suffered most: Turnip-rooted beet, total loss; Crimson Globe beet, 80 per cent. loss; Yellow Globe mangold, 80 per cent.; Long Red mangold, 40 per cent.; Early Horn carrot, 40 per cent.; Intermediate carrot, 10 per cent.; Matchless White carrot, no loss. Parsnips appeared quite sound when ploughed out and planted in the spring. Probably 50 per cent. of the roots, however, developed a rot round the crown, for which we can find no explanation beyond frost injury. Fortunately, it did not materially affect the yield beyond a possible 2 per cent. During the same winter potatoes stored in the sheds were damaged, and a few which had frozen solid collapsed on thawing. The majority, however, showed only the usual frost injury, indicated by discoloration of the vascular tissue, which is brought about by exposure to a temperature of 26° to 27° F. for several hours.

We have never been fortunate enough to be able to harvest our parsnip roots before or during the winter. These have been left till the spring, and are ploughed out early in August, sorted, and immediately transplanted. There is some risk in doing this, as wet weather in August may cause delay, in which case the roots immediately commence to grow. Carrots, mangolds, and beets are dug by hand, but parsnips are ploughed out, and the fact that they are severed 8 in. to 9 in. below the crown apparently does not affect the yield of seed sufficiently to warrant hand digging.

The proportion of selected roots reserved for seed purposes rarely exceeds 33 per cent. of the total yield of carrots, 50 per cent. of parsnips and beet-root, and up to 75 per cent. of mangolds. These are topped, and pitted by stacking them upon the bare ground, covering with soil and a thick thatch of straw. In the spring they are carted direct from the pits and transplanted.

(To be continued.)

A NEW JERSEY CHAMPION—"VIVANDIERE."

ON 5th August the Jersey cow Vivandiere, bred and owned by A. Christie, of Tanekaha, North Auckland, completed her 365 days on certificate-of-record test. She commenced test at the age of six years and ten days, and her final record stands at 17,282·1 lb. of milk containing 1,036·09 lb. of butterfat. This constitutes a New Zealand record for the Jersey breed, the performance of the previous champion, Pretty's Flirt, having been exceeded by 598 lb. milk and 25·6 lb. butterfat. Vivandiere's record is all the more remarkable in that it was made on twice-a-day milking. It is expected that she will fully qualify for her certificate by calving well within the period prescribed by the rules. She is due to calve on 14th September, which will be less than six weeks after the termination of her 365 days of authenticated milking. Mr. Christie is to be congratulated upon the breeding, developing, and handling of the new champion, and also upon what is probably the world's record butterfat production for twice-a-day milking.

—W. M. Singleton, *Director of the Dairy Division.*

IRRIGATION AND ITS PRACTICE.

III. METHODS OF APPLYING WATER AND PREPARATION OF THE LAND.

(Continued.)

R. B. TENNENT, N.D.D., Instructor in Agriculture, Dunedin, and J. R. MARKS, A.M.Inst.C.E., M.N.Z.Soc.C.E., Resident Engineer, Public Works Department, Alexandra.

FURROW IRRIGATION.

IN the furrow method of irrigation small furrows or corrugations are made in the direction of the slope and connected with a head-ditch supplying water. As a general rule this method is used in the irrigation of orchards, small-fruits, root crops, maize, sorghum, and vegetables (Fig. 36). Usually a number of furrows are carrying water at once, and their length and size depend upon the soil, slope, and amount of water required. The length of the furrows should be such that for the given carrying-capacity both ends will be irrigated alike and to a proper depth. Speaking generally, the furrows will vary in length between 200 ft. and 500 ft. Where the soil is extremely porous the furrows will be comparatively short, and where the soil is tighter the reverse will be the case.

In preparing land for the furrow irrigation of crops it is usually desirable that the field should first of all be irrigated by a flooding method, in order to moisten the soil sufficiently so that the seed when sown or planted will germinate and be given a good start. When the crop shows through the ground, furrows are ploughed in the proper positions, or are made by the use of a special furrower, which will be described later. The sowing of the crop must, of course, be arranged so that the drills run parallel with the fall of the land. The furrows are made in such a direction that a little stream of water will flow freely down them without washing away the soil. Water is taken from the head-ditch, which follows approximately the contour of the surface, into the distributing-furrows, which may be parallel with the ditch or diverge from it. If the land is nearly flat the furrows can be run directly away from the distributing-ditch, from the upper to the lower level of the paddock. If, however, as shown in Fig. 37, the slopes are steep the furrows should be ploughed diagonally to the slope, so as to reduce the velocity of flow in them.

Water is diverted into a number of these furrows and makes its way slowly towards the lower end. As soon as this point has been reached the stream is shut off and turned into another set of furrows, and so on until all have been watered. The fall given to the furrows determines to a certain extent the amount of water received by the soil. Where the fall is very gentle the water moves slowly, and a large portion sinks in while the furrow is being filled; if steep, the water quickly passes to the lower end, and the ground does not have time to absorb as much.

In turning the water from the head-ditch into the furrows the common practice in Central Otago is to make openings in the lower



FIG. 36. FURROW IRRIGATION OF YOUNG FRUIT-TREES AT GALLOWAY EXPERIMENTAL AREA.

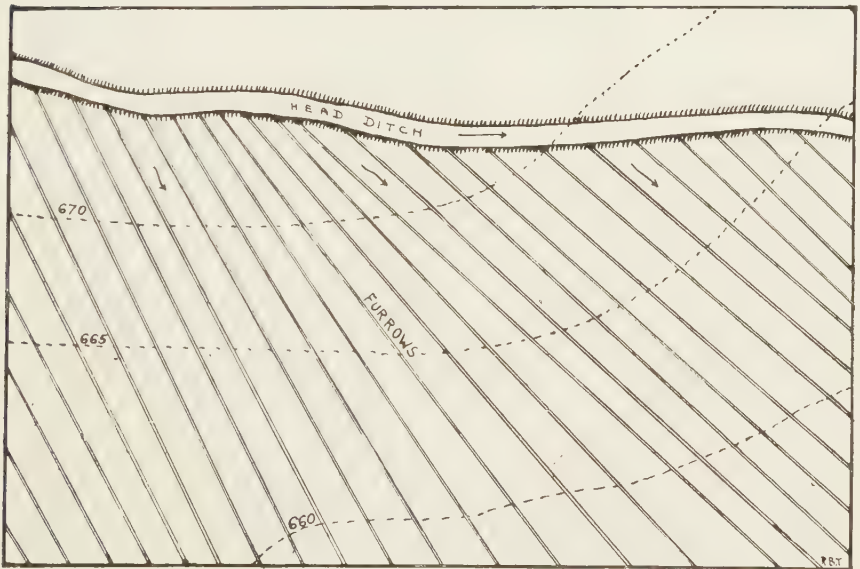


FIG. 37. SKETCH OF FURROW IRRIGATION ON STEEP SLOPE.

[Original.]



FIG. 38. CEMENT-LINED DISTRIBUTING-DITCH.

[Newell—"Irrigation,"

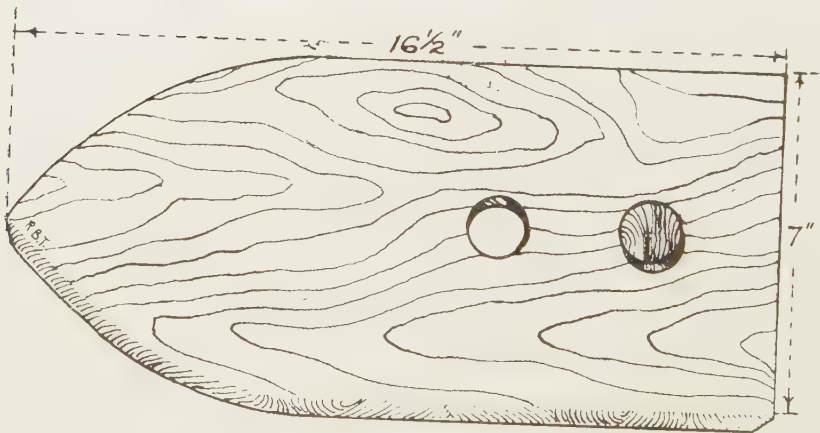


FIG. 39. WOODEN TAPOON AS USED AT GALLOWAY EXPERIMENTAL AREA.

[Original.

bank with a shovel. If water is allowed to flow through earth openings in this manner for even a short period the distribution usually becomes unequal. The banks of the ditch readily absorb water and become soft. Erosion takes place and the openings are enlarged, permitting greater discharges and thus lowering the general level of the water in the ditch, so that some of the remaining furrows have little or no discharge. Where orchards or fields permanently laid out for furrow

irrigation are under consideration it would certainly be more economical to erect a permanent head-ditch into which are let lengths of 1 in. pipe blocked by a wooden plug. The erection of concrete or wooden head-ditches with sliding openings is usually adopted in America and in other countries. The permanency and absolute control of the water are features which recommend this type of structure (Fig. 38). Wooden tapoons can also be easily prepared, and are exceptionally useful in making outlets from earthen head-ditches. Fig. 39 shows the type used at the Galloway Experimental Area. This tapoon consists merely of a board of sufficient width to extend across the furrow. Where it is desired to let a certain amount of water pass this point one or more holes are bored in the tapoon, these being closed by a wooden plug when not in use.

From the foregoing it will be realized that for orchards the furrow method is the one likely to be used most generally. Occasionally one comes across orchards irrigated by six to ten shallow furrows between each row of trees (Fig. 40). It is generally recognized that two deep furrows 8 in. or 9 in. in depth, and running as close to the tree-limbs as can conveniently be done, are preferable when lateral percolation is not too slow. Where two such furrows are not sufficient four usually will be. The chief advantage of the furrow method of irrigating orchards, over the basin-check method previously described, lies in the smaller evaporation from the furrows and the elimination of caking of the surface soil.

PIPE IRRIGATION.

Only brief mention need be made of the variations in the system of utilizing pipes for irrigation purposes. Speaking generally, the use of pipes means a considerable outlay of money, and consequently the practice is not recommended unless under special circumstances. In certain cases pipe-lines take the place of head-ditches in the irrigation of orchards by the furrow method, and where sufficient outlets are allowed the system is excellent. A certain amount of sub-irrigation is also employed in various countries, porous hydrants being connected with an extensive piping-system. Fig. 41 shows an overhead spray system in use. This method, which was almost completely confined to the watering of lawns, has during recent years been extended to the irrigation of agricultural fields. As can be realized, only the most remunerative and most productive types of crops would warrant the expenditure necessary to install such a system. The large profits derived from such crops, the cost of fertilizers, the uneven character of the soil, the growing of two or more crops on the same field in one season, and the advantage of being able to control the soil-moisture in cultivating and recropping might justify, under favourable conditions, the heavy expense. In some systems the pipes are permanently fixed on overhead standards. In others they are laid about 1 ft. beneath the surface, so that they cannot be disturbed by the plough. The movable-pipe system is frequently used in Australia, and has the advantage of being less costly in the initial outlay, but it entails more labour in operating.



FIG. 40. FURROW IRRIGATION OF ORCHARD.

[Newell—"Irrigation."]



FIG. 41. OVERHEAD SPRAY IRRIGATION, SHOWING PIPING.

[Fortier—"Uses of Water in Irrigation."]

IV. IRRIGATION IMPLEMENTS.

Certain special implements are essential to the irrigation farmer in order to facilitate the preparation of his land for irrigation and to reduce the cost of such preparation to a minimum. No mention will here be made of the common farm implements usually used on the majority of New Zealand farms, attention only being directed to those special implements with which the average irrigator is as yet unacquainted, but which, we venture to say, will in the course of the next few years be looked upon as an essential complement to every irrigation farmer's equipment.

LEEVE RIDGER.

Attention has already been drawn to the fact that the levees in the border-dyke method of irrigation can be formed roughly by employing an implement known as the levee ridger. Fig. 32 (in the June *Journal*) shows the ridger in operation, while Fig. 42 gives a fair idea of how it may be made. The construction of this simple implement can readily be carried out on the farm, and it certainly should be in the hands of every farmer utilizing any system of irrigation in which low levees are employed. The levee ridger is drawn by two horses, with the wide end to the front. This wide end skims a thin layer of earth from the surface, heaping it together and letting it pass through the narrow rear end in the form of a slightly raised ridge. The dimensions of the ridger may be made to suit the requirements of the farmer. The ridger used at Galloway Experimental Area has been found to be quite satisfactory, the width of the front end being 6 ft., the length 9 ft., and the width at the narrow end 2 ft. 6 in. Weight is obtained by the driver standing on the central footboard.

SPECIAL PLOUGHS.

Generally speaking, the average irrigator will find the single-furrow swing plough of great advantage in forming furrows and preparing the way for ditches. Figs. 43 and 44, however, show two types of ploughs which merit consideration. Where furrow irrigation and any other controlled method of irrigation is employed, ploughing around the field should always be avoided, and all dead furrows should be eliminated as far as possible by back-furrowing into them several times. The lands in such cases should therefore be of considerable width, even if time is lost at the headlands. The ploughs illustrated are of a type greatly in vogue in the United States, in that they do away entirely with both back and dead furrows, since all furrows are thrown in the one direction. The plough is a sulky, and is made in two types, called "reversible" and "balance."

The reversible type consists of right-hand and left-hand mouldboards and shares set opposite each other on a beam. When the end of the field is reached the plough is thrown out of the ground and reversed by means of handles at the back, and when the implement is turned round the other plough throws the furrow in the same direction as the previous furrow. Another type, accomplishing the same purpose, consists of a sulky frame carrying right-hand and left-hand mouldboards, with levers for raising and lowering them, so that either can be held out of the ground while the other is in use.

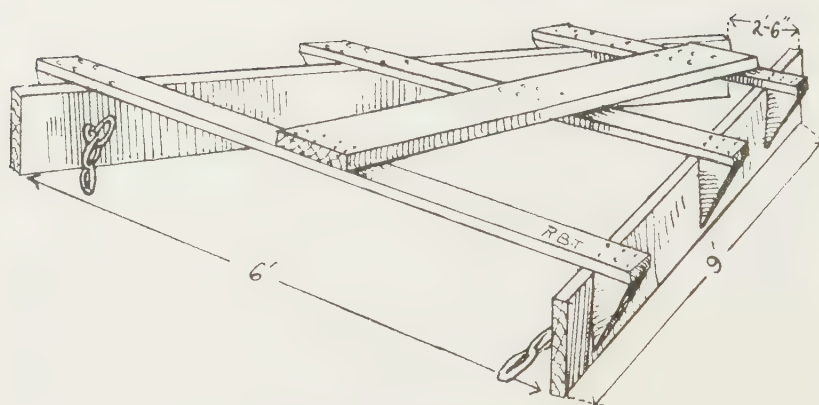


FIG. 42. LEVEE RIDGER.

[Original.]

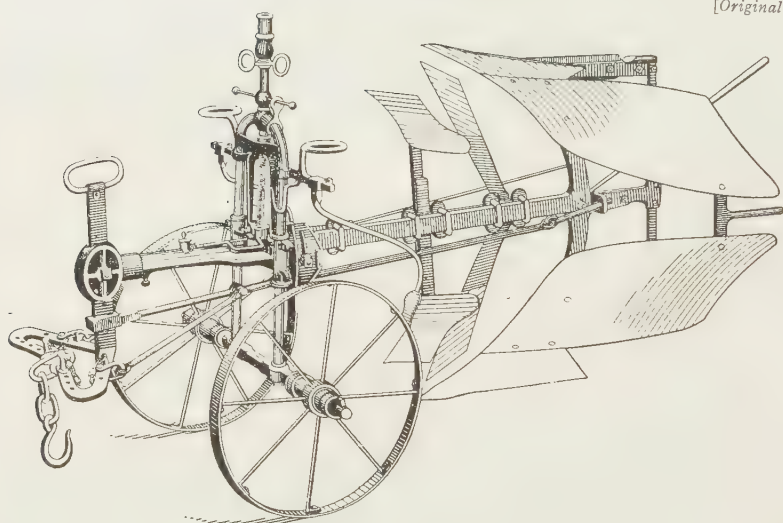


FIG. 43. REVERSIBLE PLOUGH.

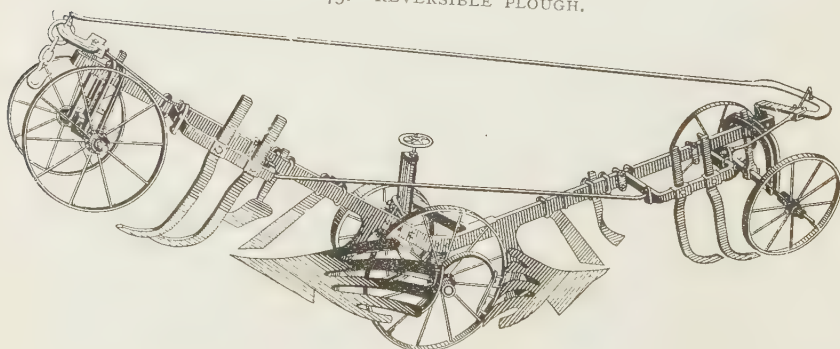


FIG. 44. BALANCE PLOUGH.

The balance plough consists of one or several ploughs in gangs, fastened to two frames which are set at an angle of 135° to one another, the axle and wheels being at an angle (Fig. 44). One frame contains right-hand and the other left-hand ploughs. The drawbars at the ends are joined by means of a heavy round steel rod, and a loose ring connects the team to the drawbar, so that when the end of the field is reached the team is swung round on the unploughed ground and the ring travels from one drawbar to the other by way of the rod; when the team is started up again one plough is pulled out of the ground and the other into it, thus obviating the necessity of throwing the plough out, as in the case of the reversible type.

[EARTH-CROWDER.

One of the most frequent and heaviest operations in the preparation of land for irrigation is the formation of head-ditches. This operation can be largely simplified by the use of what is termed an "earth-crowder." Fig. 45 shows how this implement can be constructed by the farmer himself, and from the writers' own experience the crowder is well worth using. In forming head-ditches a few furrows are ploughed on the site of the ditch. The crowder then comes into operation, as can be seen in Fig. 46, and the earth is packed to the sides. Fresh furrows are then ploughed, and the crowder again brought into operation. Its use, as will be recognized, greatly facilitates the building of the banks of the head-ditch, and it is strongly recommended to irrigation farmers on this account.

FURROWING-SLEDGE.

Where furrow irrigation is to be carried out it is desirable to have a suitable implement with which to quickly form the furrows along which the water will flow. Taking for granted that a drill with furrowing attachment has been used in seeding, thus marking out the rows, or that the drills have been marked in some other convenient manner, the furrowing-sledge can then be brought into use.

The irrigator will, of course, construct a sledge according to his own requirements, and the home-made implement shown in Fig. 47 will serve as a pattern from which a furrowing-sledge may be constructed. It is made of 6 in. by 6 in. timber, 42 in. long for the runners, and wide enough to straddle two rows. These timbers are set to run on edge, and are sharpened at the front end, being armed with cultivating-tines which about fit them. The runners are securely spiked together at the back end, with 2 in. boards upon which the driver rides, and are connected in front by a 4 in. by 4 in. piece of timber, to which the draught is attached. Two horses are preferable in using this furrower, as the sledge can then be driven much straighter. The implement has the advantage over the ordinary furrowing attachment of cultivators in that it makes a smooth even furrow, without clods to interrupt the flow of water. With it furrows can be placed in alternate rows or in every row, as desired. Further runners could be placed on the sledge to furrow out more than two rows at a time, except that slight unevennesses in the surface will prevent the making of as good a job. Smooth furrows, especially for irrigating seed (a practice not generally recommended), are most essential, and no other implement can be secured to give as good results as this simple one.

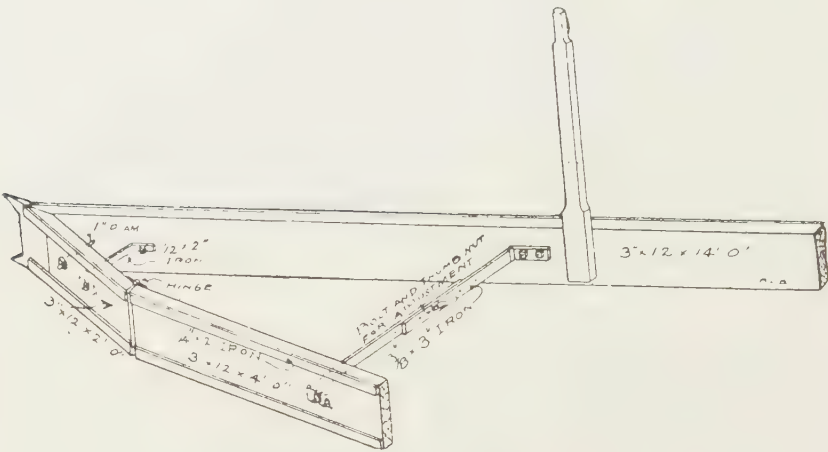


FIG. 45. ADJUSTABLE CROWDER.



FIG. 46. USE OF THE CROWDER IN BUILDING HEAD-DITCHES.
[Fortier—"Irrigation of Orchards,"

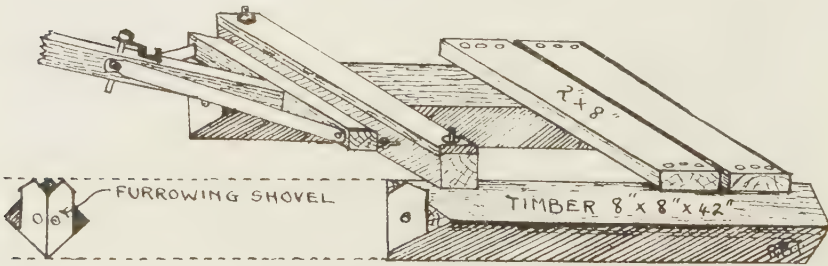


FIG. 47. FURROWING-SLEDGE.

[Original.

SCOOPS.

Where a considerable amount of grading has to be carried out the use of a scoop or grader, if procurable, is to be recommended. The scoop is easy to handle, and is very suitable for forming roads, building levees, digging ditches, or carrying out any work requiring the removal of earth. The scoop illustrated in Fig. 48 is a most effective implement for the removal of loose or sandy earth where the haul is short. In practically every case, if efficient work is to be done, three good horses abreast are necessary. Its chief points of recommendation are strength, portability, and wide ranges of use, quick loading, and little loss of time in transportation. After the dumping of a load the team may be readily turned, and when empty the scoop is drawn with sagging traces. This type of scoop can be procured in New Zealand for approximately £7.

A modification of the ordinary scoop is termed the "buck scoop" (Fig. 49). This type of scraper is well suited to land where the grading

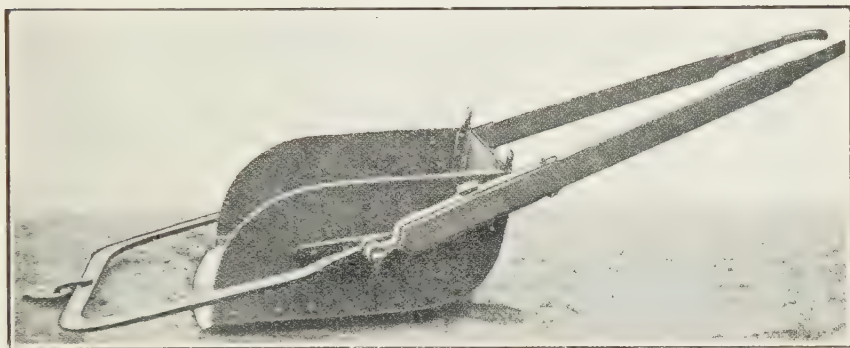


FIG. 48. LEVELLING-SCOOP.

[P. and D. Duncan, N.Z.]

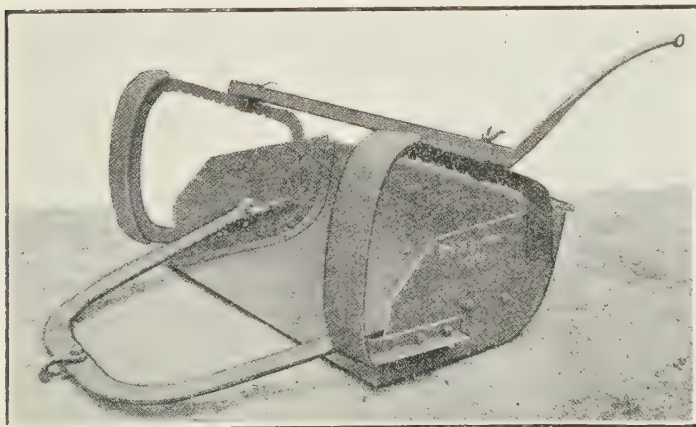


FIG. 49. BUCK SCOOP OR GRADER.

[P. and D. Duncan, N.Z.]

is heavy and the haul long. The single steel handle, about 4 ft. long, attached at the middle of the back of the scoop serves both as a means of regulating the dip in loading and of dumping and spreading the load. Usually a short piece of rope is attached to the end of the handle to facilitate turning the scoop back into position preparatory to loading. The scoop illustrated is 4 ft. 6 in. in width, and is drawn by four horses. Manufactured in New Zealand its price is £12.

THE FINISHING LEVELLER.

The leveller as an implement requires only a brief description, and Fig. 50 illustrates a type most suitable for Central Otago. As can be seen, the leveller consists of a rectangular framework well stayed with a central cross-piece bolted flush with the bottom of the side runners. This cross-piece catches any inequalities in the soil and

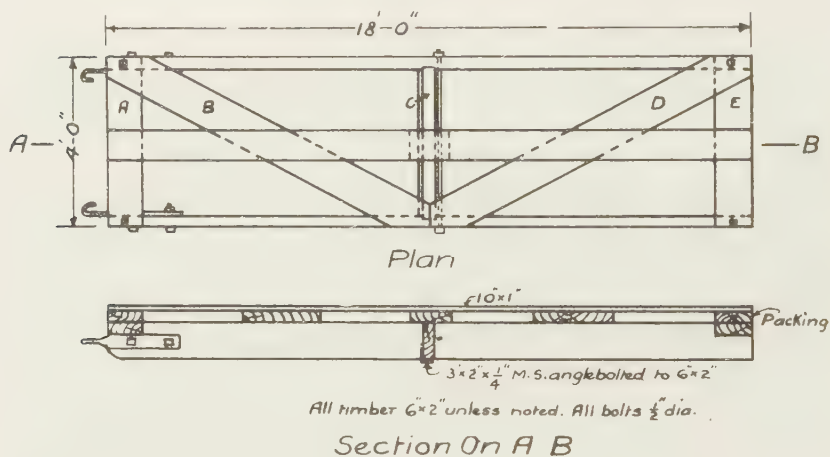


FIG. 50. FINISHING LEVELLER.

[Original.]

deposits the elevated portion into any depressions which may exist. The writers cannot overstress the great necessity for farmers to make use of an implement of this nature for putting the finishing touches on their land prior to irrigation. A well-graded and well-levelled surface is essential on land with a slight fall. It must be clearly understood, however, that the leveller does not take the place of the grader or scoop. Grading is cut-and-fill work necessary to make a generally even surface. It comprises the cutting-off of decided hummocks and the filling-in of decided hollows. For steep hillsides grading of this nature is not so necessary, but for flatter country it is essential. The scoop or road-grader is therefore the implement to use for this class of work, and the leveller is intended only to put a fine even finish on the rough preliminary grading.

(To be continued.)

ASHBURTON EXPERIMENTAL FARM.

NOTES ON OPERATIONS, SEASON 1923-24.

F. E. WARD, Instructor in Agriculture, Christchurch.

THE season under review in the mid-Canterbury district may be described as consisting of a wet winter, a very dry spring and summer, and a mild autumn. In consequence of the dry growing-period no heavy cropping can be recorded from the Ashburton Experimental Farm. Poor results were obtained from roots; the cereals, being spring-sown, did not give good yields; and the returns from grass and lucerne were below the average. The Farm Overseer, Mr. J. G. McKay, carried out the work in his usual efficient manner, and has furnished reports from which these notes are compiled.

PASTURE.

A field intended for a horse-paddock was sown on 20th March, 1923, with the following mixture per acre: Perennial rye-grass, 6 lb.; cocksfoot, 15 lb.; crested dogstail, 2 lb.; red clover, 5 lb.; white clover, 2 lb.: total, 30 lb. It will be noted that this has a much higher proportion of cocksfoot to rye-grass than is usual under Canterbury conditions, but where permanent pasture is required the mixture as given can be recommended. A portion of this paddock was shallow-ploughed two months earlier than the deep-ploughed parts, and on this portion the grasses and clovers came away much quicker, no doubt due to the effects of weathering. It provides another demonstration of the advantages of early ploughing. A portion of the paddock dressed with 2 tons of carbonate of lime prior to sowing showed no beneficial results from the application. Experiments with lime, both burnt and carbonate, on pasture lands are now being conducted in Canterbury to ascertain the efficacy of such treatment.

Paspalum.—A mixture containing rye-grass, red clover, and paspalum sown two years ago was autumn-grazed, then closed for hay, and subsequently grazed again. The sowing of 5 lb. per acre of paspalum should have produced some plants, even presuming the germination was low, but none has been observed. The writer has observed a few isolated plants in one or two places in Canterbury, but in the main it would appear that the winters are too severe for this grass in the district.

TOP-DRESSING TEST.

A top-dressing experiment was carried out during the winter and spring on a 10-acre pasture. Half the pasture had been sown down with rape in November, 1920, and the other half with grass following rape in April, 1921. The area was divided into seventeen plots, having fourteen treated plots of $\frac{1}{2}$ acre each and three controls of 1 acre each. The following treatments were given:—

Plot 1: Control (no dressings). Plot 2: 5 cwt. burnt lime in July; 2 cwt. superphosphate in September. Plot 3: 10 cwt. burnt lime in July; 1 cwt. superphosphate in September. Plot 4: 10 cwt. burnt lime and 1 cwt. superphosphate in July. Plot 5: 5 cwt. burnt lime and 2 cwt. superphosphate in July. Plot 6: 5 cwt. burnt lime in July; no super applied. Plot 7: 10 cwt. burnt lime in July; no super applied. Plot 8: No lime; 2 cwt. superphosphate in September. Plot 9: Control (no dressings).

The remaining plots were repetitions of those detailed.

With the exception of a light stocking for five days in October, stock was kept off the area till 12th November. Heavy stocking was purposely delayed in order to give the dressings time to act and make any difference between treated and untreated plots more easily discernible. However, no appreciable difference was apparent previous to the heavy stocking in November. It was noted in subsequent growth that on the plots treated with lime and super in July the red clover came away quicker than on any others. In fact, these were the only plots where a difference was noticeable at any time. This fact leads one to think that better results would be obtained if the manures were applied during winter instead of early spring. The dryness of the season must, of course, be taken into account in this case.

The whole of this section was skim-ploughed during February, worked up in March, and deep-ploughed in April. A wheat trial consisting of sixteen varieties, and using College Hunters as a control, is being carried out. In order to note the effect of these top-dressings on a cereal crop the wheat plots have been sown across the top-dressed areas.

DANISH COCKSFOOT.

The area of 2.4 acres previously laid down with Danish cocksfoot in wide drills was again harvested for seed. The area was heavily stocked with sheep during August, 1923. When the stock was removed the cocksfoot was cultivated, and a top-dressing experiment was commenced on 6th September. The area was divided into seven plots and treated as follows: Plot 1, 2 cwt. super; plot 2, control; plot 3, 2 cwt. super; plot 4, control; plot 5, 1 cwt. super, 1 cwt. blood; plot 6, control; plot 7, 1 cwt. super, 1 cwt. blood. Further cultivation immediately followed the application of manures.

The results have been disappointing. Owing to the very dry weather experienced it was decided to treat the experiment as an observation test only. At no time has there been any apparent difference between treated and untreated plots. A greater amount of straw might reasonably have been expected from the treated plots, but this was not evident. The aftermath shows an equal growth on control and treated plots. It was decided not to graze the aftermath during the past autumn in order to note the effect of non-stocking on next season's seed crop.

The seed crop this past season was harvested on 18th December. The threshing-mill would not make a satisfactory job, and the bulk of the stuff was hand-threshed. The amount of seed bagged, including blowings and husks from the mill, amounted to 450 lb., or 187.5 lb. per acre. There will be some difficulty in estimating the exact amount of pure seed produced, owing to the fact that in the case of the machine-threshed sample the kernel was taken out of the chaff. The usual dressing methods would remove this chaff or husk, which should really be added to the seed-weight.

CEREALS.

Wheat.—A variety trial was made on land previously occupied by roots and fodders. The land was grubbed during May and deep-ploughed in June. It was worked with disks and harrows, and the following wheat varieties were sown on 16th and 17th August, 1 cwt.

of super per acre being applied: Velvet Chaff, Marquis, Major, Velvet (Ngapara), Queen Fair, White-straw Tuscan, Red Fife, Zealand, Turretfield Eclipse, Queen Fan, Jumbuck, and Essex Conqueror. Originally 180 varieties of wheats had been tried on the farm, and the foregoing were selected from these.

The varieties now listed had previously been either autumn- or winter-sown, and it was hoped to get some useful information regarding their habits when spring-sown. At least four of these varieties are not suited to spring sowing—namely, Velvet Chaff, Ngapara Velvet, Essex Conqueror, and Red Fife, although the last-named made better growth than the three others. All the varieties in the test are now being used in a trial against College Hunters on Section 4. The varieties Turretfield Eclipse and Queen Fan were affected with loose smut, the latter only slightly. Major, a notoriously bad smutter in some localities, was practically free from smut here.

Short rows of twenty-three wheats and one barley variety from Dookie Agricultural College, Victoria, were sown on a portion of this field, also four varieties from Canada. These will receive a further trial before comment is made on them. The four Canadian varieties were Canada, Bishop, Huron, and Early Red Fife. Three rows of a Solid-straw Velvet, secured by the writer from a crop of Ngapara Velvet, were sown alongside these varieties on 17th September. This Solid-straw Velvet appears to be a wheat that would adapt itself to autumn rather than spring sowing, being a slow grower with a similar habit of growth to Velvet Chaff.

Barley.—A plot of Swedish Gold barley was sown on 3rd October, and yielded 30 bushels per acre. The grain produced was similar in size and general appearance to the sample sown, and was not up to the standard of the varieties usually grown.

Oats.—On a field sown with Garton oats in the spring, with and without superphosphate, the latter at the rate of 1 cwt. per acre gave a marked result. The early growth of the manured areas was remarkable, and kept the fat-hen well in check. On certain unmanured parts the fat-hen was almost as tall as the oats by reaping-time. In comparing samples of seed from manured and unmanured areas on the heavier and the lower-lying lands it was found that the unmanured produced a somewhat plumper sample than the manured. On the lighter soil, however, the samples were about equal, with a bulk of straw and larger heads in favour of the manure.

TURNIPS.

In order to assist the Entomologist, Mr. D. Miller, in his investigation of the "turnip-fly" pest, sowings of turnips were made approximately at intervals of two weeks, commencing on 24th November and ending on 5th February. The varieties used were Fosterton Hybrid, Centenary, Imperial Green Globe, and Hardy Green Globe. Investigation has proved that the grass-grub beetle is responsible for most of the damage done to rape and turnip crops during November and early December. A January-sown crop did not suffer to the same extent as the earlier sowings. January is late, however, for sowing turnips other than the white-fleshed quick-maturing varieties if good yields are to be expected. At time of writing (July) dry-rot is in evidence on the earlier-sown plots, and the bulbs on the later-sown

plots are very small. The diamond-back moth has been at work for some time past. With the dry season and the ravages of insect pests, the crop has been a very light one.

SUGAR-BEET.

An area was sown in sugar-beet with the object of securing information on manuring, rate of seeding, width of rows, and spacing. The seed, which was imported from Victoria, was late in arriving, and in consequence the roots were small. It is intended to write a special note on these trials when weighings have been taken.

POTATOES.

Variety and cut *versus* uncut seed tests were again carried out—one hundred sets of each, fifty cut and fifty uncut. The varieties used and the yields of those dug at time of writing are as follows:—

Variety.	Treatment of Seed.	Yield.		
		Table.	Seed.	Pig.
		Tons.	Tons.	Tons.
Reading Russet ..	.. Uncut ..	7.06	2.80	1.08
" ..	.. Cut ..	6.14	4.48	1.32
Snowdrop ..	.. Uncut ..	2.80	5.36	3.36
" ..	.. Cut ..	1.11	5.26	2.64
Manhattan ..	.. Uncut ..	5.36	2.44	0.84
" ..	.. Cut ..	4.63	2.19	1.20
Dakota ..	.. Uncut ..	5.61	2.07	0.48
" ..	.. Cut ..	6.65	1.70	0.36
Bresee's Prolific ..	.. Uncut ..	2.80	3.55	2.28
" ..	.. Cut ..	2.68	4.60	3.72
British Queen ..	.. Uncut ..	4.39	2.66	0.96
" ..	.. Cut ..	4.02	3.16	1.56
Auckland No. 3 ..	.. Uncut ..	4.63	2.19	0.48
" ..	.. Cut ..	4.02	2.07	0.72
Arran Chief ..	.. Uncut ..	1.58	2.66	1.32
" ..	.. Cut ..	1.09	3.02	1.56
Up-to-Date ..	.. Uncut ..	2.92	1.58	0.84
" ..	.. Cut ..	2.56	1.95	1.32

Total of table potatoes from uncut seed, 37.15 tons; from cut seed, 32.90 tons.

Total of seed potatoes from uncut seed, 25.31 tons; from cut seed, 28.43 tons.

Total of pig potatoes from uncut seed, 11.64 tons; from cut seed, 14.40 tons.

Total of marketable potatoes from uncut seed (table and seed), 62.46 tons; from cut seed, 61.33 tons: Balance in favour of uncut seed, 1.13 tons.

Mr. McKay reports: "The method of cutting the sets for these plantings was somewhat different from that of previous seasons. Usually the sets are cut through from rose to stem end, and both halves are planted, provided that sufficient eyes—two or more—are present in each half. This season the sets were sliced down the side, leaving the rose end intact, and this portion only was planted. It will be seen that the proportion of seed and pig to table potatoes was greatest where cut seed was used. In past experiments the results were in the main in favour of uncut seed. It has been suggested by some growers that the centre eye in the rose end of a potato produces more small potatoes than the others. There may be truth in this theory, as this eye is usually destroyed when potatoes are carefully cut from rose to stem end. In an endeavour to obtain something definite regarding the

relative values of the rose end *versus* stem end as tuber-producers an experiment was carried out here some three years ago. In a good many cases, however, the stem ends rotted in the ground without sending up shoots. The variety used for the test was Arran Chief."

SHEEP-FEEDING TRIAL.

For this trial a paddock was divided into two plots of 8 acres each. Ten ewes per acre were wintered from May onward on one block, with a supplementary ration of lucerne hay; on the other block two ewes per acre were carried without supplementary feed. The lucerne-fed ewes wintered well so far as feeding of dry lucerne was concerned, but foot-scald caused a great deal of trouble, and the ewes had to be moved to other pastures from time to time. It was ascertained that about $3\frac{1}{2}$ lb. of hay per day per sheep was required for food and unavoidable waste. Owing to the ease with which the sheep got their food they lacked exercise, and consequently trouble was experienced at lambing-time. On the grass-only area no difficulties were encountered, either from foot-scald or at lambing, and the death-rate was much lower than that of the lucerne-fed ewes. The lambs of the lucerne-fed ewes were fattened on green lucerne, and those of the grass-fed ewes were sold fat off their mothers. The former were the bigger lambs when dropped, but when fattened there was little to choose between the two lines.

LINSEED.

Two varieties of linseed imported from Canada—namely, Ottawa 53 and Premost—were tried, but an excessive growth of fat-hen militated against a satisfactory yield. The quality of the linseed produced was not superior to that of the varieties in common use here.

LUCERNE.

The established areas of lucerne were used for hay and grazing. The spring yield of hay was good, but the dryness of the summer was responsible for very light yields in subsequent cuts. The areas grazed were in some cases fed off six times during the season without any apparent injury to the stand. The cultivation of the wide-rowed areas was reduced to a minimum; it seems evident that summer cultivation does not pay. Any increased yield that might result from summer cultivation would not compensate for the cloddy condition of the hay harvested, nor pay the cost of working. Thorough cultivation in the autumn and spring, however, is strongly advocated.

MISCELLANEOUS.

The orchard served a useful purpose in providing instruction in pruning and spraying to the boys of the Ashburton High School and Technical College, the instruction being given by Mr. L. Paynter, Orchard Instructor in Canterbury. Throughout the year the boys have received practical instruction in general agriculture from Mr. McKay, who has also demonstrated the uses of the various farm implements.

A small area in the orchard section sown several years ago with *Phalaris bulbosa* now forms part of the horse-paddock. This grass is evidently quite permanent on the low-lying places, where it makes abundant growth.

THE LATE SIR WALTER BUCHANAN, M.L.C.
1838-1924.



PIONEER SETTLER AND PROGRESSIVE FARMER. FOUNDER OF THE CHAIR OF AGRICULTURE AT VICTORIA COLLEGE, WELLINGTON—THE FIRST AGRICULTURAL CHAIR UNDER THE UNIVERSITY OF NEW ZEALAND.

The Chair now occupied by Professor G. S. Peden was established by the foundation gift of £10,000 made by Sir Walter Buchanan last year and since subsidized, pound for pound, by the Government.

SEASONAL NOTES.

THE FARM.

TILLAGE OPERATIONS.

LAND intended for the coming season's root crops should be given a second ploughing before the end of September, or as soon as soil conditions are favourable. From then on till sowing-time the soil should be stirred occasionally, with the object of killing weeds and ensuring a mellow tilth. Owing to the prevalence of club-root in turnips it is advisable to keep this crop as far apart as possible in the rotation.

Areas selected for potatoes—which would be preferably out of lea, skim-ploughed early—should now be cross-ploughed deeply as soon as conditions permit, and thoroughly stirred with the cultivator from time to time. It is better not to work the old sod down to a very fine tilth, so long as it is well broken. Potatoes are very partial to a somewhat open free tilth, which is usual after grass. Work should be regulated with the object of planting towards the end of October for the main crop. The seed should be carefully picked over as opportunity offers, and only good sound seed of even size (about the size of a hen's egg) selected.

Land for rape should be further prepared as occasion permits with the object of making a first sowing on warm land with a northerly aspect from the middle of October—weather permitting—and the main sowing early in November. Rape is a crop which repays good tillage.

In the North Island light fern-country is often ploughed in September, as the young fern-shoots are then very vulnerable. This land is generally sown with either rape or turnips in November and December, but it is good practice to plough now and give a second ploughing or thorough disking shortly before sowing. Where fern is troublesome on established grasslands a good harrowing with the heavy tripods will do good work by bruising and breaking the young fronds.

SPRING SOWINGS.

September is a good month for sowing special crops for hay or ensilage, Algerian oats with tares or peas being about the best at this time. A mixture of 2 bushels of oats and 1 bushel of tares or $1\frac{1}{2}$ bushels of peas per acre may be recommended. Either variety of tares will do, but Golden are the best for spring sowing, while Grey Partridge and Early Minto are suitable varieties of peas. This type of crop may also be used for feeding out green. Super or basic super, 2 cwt. to 3 cwt. per acre, are suitable fertilizers. Italian and Western Wolths rye-grass and cow-grass make another fine class of hay, using 15 lb. of each as a mixture with 5 lb. or 6 lb. of cow-grass per acre, or 30 lb. Italian with the same amount of cow-grass.

Oats and mustard sown now make a good bite for ewes and lambs before the rape is ready. About 6 lb. of mustard per acre may be sown with the oats.

In Canterbury it has often been found that the germination of the mangold crop is adversely affected by dry conditions resulting from late sowings. Sown in September the young plants have a better chance of establishing a good root-system before the usual drying nor'-westers make their appearance, and are thereby better enabled to withstand a dry season. Whether the crop is sown in ridges or on the flat must depend on local conditions, wetter areas being more suited to ridging. If amount of moisture is likely to be a serious limiting factor to growth it is advisable to sow on the flat. Recent experiments show that, besides requiring less work, the yield on the flat in Canterbury has usually been the heavier.

Cereals for threshing or chaffing were dealt with last month.

CLOSING FOR HAY.

Meadows intended for hay or ensilage should be thoroughly fed down, well harrowed to ensure a clean bottom for the mower, and shut up at the end of September or early in October. If not already done the ground should be top-dressed with super or basic super, at 2 cwt. to 3 cwt. per acre. By shutting up early the farmer is enabled to get the hay crop cut early, which allows a better growth of aftermath before the dry, hot weather sets in, this being important if good summer and autumn feeding is desired. The early-cut hay crop is usually of much better quality than the late crop, but the date of closing is really the controlling factor in securing the proper admixture or proportion of clovers to grass. Very early closing means a higher proportion of grass to clover, whereas late closing means the reverse, so that the aim should be to close at a time which previous experience has shown will result in sufficient clovers being present.

LUCERNE.

The land will be warming up in September, and rapid growth may be expected towards the end of the month. This is the time to carry out spring cultivation where necessary. It should be clearly understood, however, that lucerne should never be cultivated in wet weather or when the land is wet. If the conditions are not suitable it is much better to delay the cultivation until after the first summer cut has been removed. The object of spring cultivation is to break the surface of the land which has become hard by grazing or by frequent rain, and allow the air to get in, also to shake up weeds and grasses that have become established.

The field to be treated should be grazed off quickly, or cut and the material raked off, before cultivation is attempted. If the land has been well cultivated during the past season, and is fairly free from grass, cultivation is simple and can be carried out by any of the ordinary cultivators fitted with lucerne points; in some cases the tine harrows weighted with a few sacks of earth will do all that is necessary. On the other hand, if cultivation was neglected and the land has become badly infested with grass the treatment must be more drastic. If the cultivator is used first large lumps of grass are dug up, and great difficulty is experienced in breaking these up sufficiently to get the land in decent order for the mowing-machine. In cases of this sort better results are obtained by giving the land one or more strokes of the disk to cut the grass into small lumps,

after which the cultivator or harrows may be used to shake it up. Care should be taken to run the disks as straight as possible, but it will be found that in some cases a little cut is necessary to bring about the desired result. Spring cultivation—in the North Island, at least—cannot be expected to kill many weeds, but if done at the right time the subsequent growth of lucerne will be heavy enough to smother most of the undesirable growths. Where it is necessary to top-dress, this should be done simultaneously with the spring cultivation, using superphosphate at from 2 cwt. to 3 cwt. per acre. The stand should have been well limed previously.

Where it is intended to establish lucerne during the coming season preparation of the land should be continued. Any crop being grown for green manure should be turned under at once; if left later it will not have time to rot thoroughly before the lucerne-seed is sown. Unless such a crop can be turned under in September it is best to feed it off with stock and turn the droppings under. Lea land should be ploughed fairly deep and the surface kept worked to destroy weeds. The same applies to land that has just grown a crop; it should be ploughed, and the first few inches of soil kept continuously stirred up till time of sowing, in order to germinate and destroy weeds. If carbonate of lime is being used, this should be applied as soon after the ploughing as possible, at the rate of from 10 cwt. to 20 cwt. per acre.

TUSsock - BURNING.

In the back country of the South Island a heavy growth of aged tussock is to be seen at various places. This should be burned during the coming month, and the work of surface-sowing with suitable grasses put in hand.

—*Fields Division.*

THE ORCHARD.

At this season of the year it is perhaps necessary to emphasize the necessity for all orchard-work to be kept well in hand. A good start is half the battle, and things done at the right time make for success. It is necessary to have all pruning completed as soon as possible. This will enable growers to carry out the other seasonal operations as they become due, such as spraying, cultivation, grafting, &c.

SPRAYING.

As mentioned in last month's notes, this work will need attention as each variety of fruit arrives at the correct stage when spraying is most effectual. Every care should be taken to cover the whole surface of the trees, including trunk, branches, and laterals. This can only be done in a satisfactory manner by spraying from each side of the tree. Three things are necessary for the work to be successful: First, good material; second, thorough and careful preparation; and third, careful application. Details of spraying at this time of year were given in last month's notes.

CULTIVATION.

Spring and early summer, when the trees are making growth, is the proper time for cultivation to be done. If the land has been turned over during late autumn or early winter it can be cross-ploughed during early spring with great advantage. If ploughing has not been carried out no time should be lost in pushing on with this work. It is bad practice to interfere with the soil when it is wet. After ploughing, the soil should be worked down to a fine tilth; this will enable the moisture to be conserved should the early summer be dry. This part of the work should receive attention at various times onward till about the New Year, when all cultivation should practically cease. The greater part of the wood-growth is made during this period, and it should not be stimulated any longer, autumn being the time when all wood-growth should ripen if it is to carry out its functions during the following year. Every care should be taken when cultivating not to damage the trees.

GRAFTING.

It often happens that varieties are not doing well or are unsuited to the requirements. These can be reworked with more suitable kinds. The trees will not be ready for this work until the end of September or early in October. The scions, however, should be selected during pruning operations. They should be selected from the trees that are healthy and vigorous and free from diseases, and, moreover, showing good cropping-qualities. The scions should be kept in a cool place until they are wanted. The best results are obtained when the stock is in advance of the scion.

There are several methods of grafting—bark, cleft, and whip-and-tongue grafting being the most commonly used. The method to be followed depends largely on the age of the tree to be grafted. On trees from about three years and upwards bark-grafting is usually practised, and is quite a simple process. The lower part of the scion is pared down, the bark of the stock drawn slightly away from the wood, and the scion then pressed in. It is necessary to bind the grafts firmly with raffia, string, or flax. They must then be covered to exclude the air. Formerly this was effected by means of a thick coating of clay, but waxing is almost universal now.

—L. Paynter, Orchard Instructor, Christchurch.

CITRUS - CULTURE.

The work of pruning all citrus-trees should now be pushed forward as rapidly as possible in order that it may be completed before the full flow of sap, which occurs just previous to the spring blossoming. Since writing the notes for last month's *Journal* very much further infection from brown-rot on both orange and lemon trees has been noticed in almost every part of the Auckland District. On account of this it is as well to emphasize the remarks made last month regarding the removal of the lower branches from trees where excessive growth has occurred, causing same to sweep on the ground or to be so placed as to prevent a free current of air through the trees. The brown-rot spores develop on the ground, and it is therefore essential that the treatment advised regarding pulverized sulphate of iron

should be carried out as soon as possible. Should the weather become much warmer during the latter part of August, spraying for the control of sucking-insects by the application of red oil, 1-40, should be carried out. However, in most localities it is probable that this spray would be more efficient if delayed until the first or second week in September.

—J. W. Collard, *Orchard Instructor, Auckland.*

POULTRY-KEEPING.

THERE should now be no delay in getting the required number of chickens hatched out before the end of September at the latest. The correct season for bringing out chickens extends over a very short period, and the end of September may generally be taken as the end of this correct season. Chickens hatched too soon—say, early in July—mostly moult just when high-priced eggs are expected. On the other hand, if the hatching is delayed until November or December the chickens seldom grow to a desired size. This not only means that they will in all probability lay small-sized eggs, but such stock also are always more susceptible to colds, roup, and other diseases than those hatched at an earlier period.

INCUBATOR TROUBLES.

Many inquiries have reached me lately as to poor results and troubles encountered in the work of artificial chick-production, but, with few exceptions, the correspondents failed to give the name of the particular make of machine they are using. In the circumstances it is next to impossible to even suggest the probable cause of the trouble. There are now so many different styles of incubators and brooders in use, together with varied methods of working them, that any definite instructions given in these notes could not be applied generally. Correspondents when asking for advice regarding the troubles they encounter should always give the name and the particular style of the incubator or brooder they are using. Without these particulars it would be merely guessing on my part to express an opinion as to the probable cause of failure.

POINTS IN BROODING.

Even in the best-managed plant where artificial methods are employed for the hatching and rearing of chicks some losses during the brooder stage are inevitable. Generally the greatest loss takes place towards the end of the hatching season, when the days are gradually getting warmer. Much of the mortality could be avoided by amending the methods of applying heat and ventilation in the brooder in accordance with the prevailing weather conditions. It is common for poultry-keepers to work their brooders in exactly the same manner in October and November as during, say, July and August, when heavy frosts are often experienced. This is a mistake. It should be remembered that during the early season the weather conditions are more uniform than is the case later; therefore the desired degree of temperature and ventilation demanded by the chicks in the brooder can be easily controlled. With the approach of

summer, however, extreme variations of climatic condition are often experienced, and it is these that have to be guarded against. It frequently happens that a hot night follows a cold one, and this is where the chief danger lies, mainly because the chicks become overheated at night, and in leaving the brooder next morning the extreme change of temperature proves too much for them, resulting in chill and its attendant troubles—white diarrhoea, droppy wings, &c. Once chicks become thus affected it is useless trying to doctor them, nor even if they are reared they seldom or never make really profitable stock. The wise poultry-keeper usually destroys such stock at the outset.

To prevent chill, the brooder should be maintained at a more or less uniform degree of temperature, but it should be so arranged that the chicks can secure a variation of warmth. In this way they are given an opportunity to move away from the heat when it is excessive, which frequently happens on a hot night. That overheating and insufficient fresh air are common causes of chill and mortality is borne out by the fact that during hot weather chicks, even when at a comparatively young age, will invariably thrive better if removed from the brooder to a colony house. No doubt this is chiefly due to the increased amount of fresh air which is made available to them. It is, however, not suggested that the chicks should be hardened off at a very young age, as this often means a check in development, and serious losses. They should be well brooded, but care should be taken to provide the desired degree of warmth and fresh air at all times. The behaviour of the chicks at night is the best guide as to whether they are comfortable or not. If the chicks are well spread out it may be taken for granted that the heat being maintained is correct, but should they appear to be huddling, then more heat is required. The spreading of the chicks should at all times be studied as well as the thermometer.

As to huddling, complaints have reached me regarding chicks crowding in corners of the house when being reared with colony-brooder stoves. I attribute this largely to the presence of a ground draught, and not excessive heat, as is usually supposed to be the cause. In working this class of brooder, provision for the admittance of an ample supply of fresh air is imperative, but this must be provided without draught. If there is a draught from any particular quarter the chicks will gradually move away from it until a corner is reached, indicating that they prefer to leave the chief source of heat (so essential for their welfare) rather than remain in the draught. They feel the need of the desired warmth, with the result that they crowd in corners, each trying to secure an inside position, which is, of course, the warmest. The huddling brings on a sweating condition, and this is fatal to chicks at any time. As a preventive I would advise placing on the floor of the house a board, say, 1 ft. high, a few feet away from the brooder, as a draught-break. If the behaviour of the chicks is observed it will soon be detected from which direction the draught is coming, so that the board or boards, as the case may be, can be placed to break the draught. Of course, care must be taken that the chicks are given sufficient space to move well away from the heat when this is excessive, especially when warm-weather conditions prevail. The boards should not be moved out

till the chicks are well settled down for the night. Even then they will be less disturbed if this is done in semi-darkness.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

BREEDING.

WITH the advent of September, colonies in a normal condition should have a good quantity of sealed brood. If, however, the absence of brood is noted, the indications point to a poor queen or that the hive is queenless. To attempt to carry such colonies through the spring months will lead to serious trouble, as they stand in danger of getting robbed out. It is a far better plan to unite such colonies than run the risk of disturbing the whole apiary. A simple method of disposing of weak and queenless hives is to unite them with strong ones, and this may be carried out by placing a sheet of newspaper over a strong colony and putting the hive to be united on the top of the paper. In the course of a day or two the hive may be examined to see that the colonies have united. Should the paper be intact it must be torn in several places, when it will be found in the course of a few days that the colonies are working peaceably. It is essential that breeding should be kept steadily going, so that the colonies will be strong in young bees to take advantage of the first flow of nectar. Food and warmth are important factors in inducing breeding, and these must have the constant attention of the beekeeper during the spring months.

FOOD - SUPPLY.

The spring is the most critical period of the year for the beekeeper, and the success or otherwise of the season's work will depend almost entirely upon his efforts to guard against the losses attendant upon starvation. Large losses occur annually through neglect in this direction. When breeding is in full swing a considerable amount of food is used up daily for feeding the brood, and, unless the weather conditions are favourable to enable the bees to work the early spring blossoms, it is essential that the food-supply be augmented. The amount of nectar gathered when the weather is favourable, in conjunction with their stores, will tide the bees over long periods, but if bad weather follows, colonies will often be reduced to a state of starvation before the owner is aware of their condition. If on examination a colony is found with insufficient stores to meet requirements preparation should be made to feed at once. It is not a safe policy to keep a colony at starvation-point, as this will prevent the rearing of a succession of young bees to take the place of the rapidly dwindling number of workers at this period.

There are many feeders on the market which can be utilized for the purpose of supplying food. The division-board feeder is the best to use at this season, as it will serve the double purpose of feeder and division-board in cases where the colony is not strong enough to occupy all the frames in the hive. When making an examination of a hive to note its condition the feeder should be placed in the hive in readiness if it is anticipated that artificial feeding will have to be

resorted to at a later period. All feeding should be carried on within the hives. Especially guard against feeding at the entrances, as that will surely produce trouble. Place the feeder on the warm side of the hive, and in cases where the clusters are small the feeder can be inserted in position next to the cluster.

A point to remember in connection with feeding is that it creates an artificial flow and is stimulating, and, when started, it must be carried on until a natural flow from the fields sets in. If there is a suspicion of disease in the apiary, do not attempt to feed honey. In any case it is not wise to use honey taken from another hive, as it is impossible to be sure of its source. Feed only the best white sugar. It is a good plan to feed in the evening, as the discovery of the syrup excites the bees, and the colony has time to settle down before the morning, and there is less likelihood of the other colonies learning the cause of the excitement. A syrup composed of two parts of water to one of sugar, fed slightly warm, will prove the best artificial feed for bees in the spring.

ROBBING.

Every precaution must be taken to prevent robbing getting a start in the apiary. Robbing may be caused by exposing combs too long when manipulating the hives, by careless feeding, and by the presence of weak and queenless colonies. These latter should not be tolerated, and the other causes can be obviated by care and attention. On no account should combs be exposed for long intervals, and if feeding has to be undertaken it should be deferred until late in the day. The excitement caused by feeding attracts other bees, and once they have tasted of the forbidden sweets they will continue to molest the hives for many days. As soon as robbing is detected it is far the best plan to postpone all operations in the apiary, and the entrances to the hives should be contracted at once. If a colony is in danger of being robbed it may be saved by piling wet grass in front of the entrance. Robbers are less likely to enter a hive so protected. Very little trouble, however, will be experienced by robbing if it is not allowed to get a start; prevention is the best plan in all cases. On no account spill syrup near the hives; do not leave combs lying about; and try to avoid weak and queenless colonies. One will then not be troubled with robbing.

DISEASE.

At each examination a strict watch must be kept for symptoms of foul-brood. If it is present, do not fail to mark colonies for treatment. Mild cases can be treated at a later period in the season, but if a colony is badly affected it is by far the safest plan to sulphur the bees and remove the combs to a place of safety. These combs can be converted into wax when a sufficient number warrant the undertaking. If isolated capped cells are discovered, these should be treated as suspicious. Healthy brood-cells are convex in form, bright in appearance, and in contrast differ greatly from diseased cells. These latter are slightly darker, concave in form, and are frequently perforated. Diseased cells of last season's production are usually so shrunken in appearance as to be easily detected, whether they are in isolated positions or surrounded by healthy brood.

—E. A. Earp, *Senior Apiary Instructor.*

THE GARDEN.

VEGETABLE-CULTURE.

URGENT work at the present season is the timely hoeing of seedling crops, the success of which depends very largely on this being done properly. Before the seedling weeds develop their second leaves the hoe should be put through them on a fine bright day, and they will be quickly disposed of. As soon as the young shoots indicate the rows in the potato crop a similar attention should be given, and a great deal of work that is a real drudgery will be avoided. Land that has carried winter crops of cabbage and broccoli should be cleaned up and cultivated as soon as it is available, and sown in root crops or planted in potatoes.

Now is the time for sowing the main crop of carrots, beet, and turnips; also celery, peas, spinach, silver-beet, and sa'ads. In the colder sections with a fair rainfall, cabbage for autumn use may be sown; a little red cabbage may well be included. In more favoured areas aubergines (egg-plants) and capsicums may be sown and raised in heat. Like the tomato-plant, they are half-hardy annuals, and require somewhat similar conditions. Their growing popularity is well deserved.

The preparation of land for tomatoes and other late-planted outside crops should be completed as soon as possible and kept in clean fallow. This affords an excellent opportunity for cleaning land, and saves a lot of work later. Reserve a piece of rich land in a cool locality for a seed-bed for winter crops, preparing it now for sowing later.

Land that has been prepared for asparagus may be planted now. The old system of crowding the plants is unsatisfactory. Large areas are now planted in rows or clumps 3 ft. or 4 ft. apart, but for ordinary purposes rows alternately 18 in. and 3 ft. apart will be more generally satisfactory. Obtain two or three-year-old plants and handle them with care. Open out a liberal trench for planting, and place them so that there is finally 5 in. of soil over the crowns. Cover them with 2 in. or 3 in. of soil at present. Hoe the land over occasionally before seedling weeds reach any size, and allow the plants to be gradually covered to the full depth. There should be no cutting of young sticks made this season, and very few next. Established beds of asparagus should receive a dressing of nitrate of soda; 2 oz. to the square yard will be usually sufficient at the present time. Beds on light land may receive a dressing of common salt a little later. Rhubarb beds that are being cropped should also have a dressing of nitrate of soda, 1 oz. to the square yard being sufficient.

Where tomato-plants are grown under glass care should be taken to see that not only is the ground prepared, but that the house is free from the infection of plant-blight. The experience of the past season will guide one in this matter. Where leaf-mould has given trouble the spores will be general throughout the house, and the crop will be more easily handled if they are destroyed before planting. Even the strings should come in for consideration where the attack has been bad. Bluestone solution, 1 lb. to 25 gallons of water, is a good fungicide for this purpose. Flowers of sulphur are sometimes burnt in an empty house before planting—1 lb. to 1,000 cubic feet being used,

and the house kept closed for twenty-four hours. Carefully examine each plant before setting it out to see that it is true to type and free from disease. After planting, houses are best kept warm by early closing, and on the dry side, till the first bunch of fruit is set.

SMALL-FRUITS.

Land prepared for passion-vines may now be planted. It should be clean, in good heart, and sheltered. The rows—running north and south—should be 10 ft. apart, and the plants 12 ft. apart in the rows. To support the vines, posts standing 5 ft. out of the ground should be placed at intervals of 24 ft., and along the tops of them two No. 8 wires should be strained side by side and about 6 in. apart. The young vines should be trained to a single stem by stopping all laterals and tying them to stakes till they reach the wires above, when four laterals are allowed to grow out and are trained along the wires each way. These form main leaders from which fruiting-laterals are grown. To keep these plants carrying heavy crops generous manuring must be maintained. Old vines should now have the fruiting-laterals pruned back to the two base buds.

Breaks of Cape gooseberries which cropped last year may now be cleaned up and given a dressing of chemical fertilizers, and the land between the rows turned over by shallow ploughing, followed by light harrowing. Established strawberry beds will also require a good dressing of manure, working it in with a light cultivator. Attend well to any necessary spraying, and keep the cultivator busy during fine dry weather. This also applies to breaks of gooseberries, raspberries, and currants as well as the preceding. Land to be planted out in Cape gooseberries next month should now be getting thorough preparation.

There has been some inquiry regarding the growing of loganberries. Those deciding to plant should get their plants in as early as possible now. Heavy land in a sheltered locality is required for good results. Large areas are usually planted 8 ft. between the plants both ways, and small plantings rather closer. The canes are usually trained on a wire trellis supported on posts 5 ft. out of the ground and placed at intervals of 30 ft., two wires being strained on them at a distance of 2 ft. and 4½ ft. from the ground. Plant deeply, and aim to get a strong growth of canes the first season.

TOBACCO-CULTURE.

If the tobacco-seed beds are not yet started a commencement should now be made without delay. It is as well to make two or three sowings at short intervals, and thus have plenty of plants and provide for all contingencies. Keep the beds free from weeds and thin out the plants where necessary. The beds must not be allowed to dry out, but when the plants are half-grown it is as well to keep them rather on the dry side. Although this crop does not require the heaviest land, it requires the best of preparation, and if the area to be planted is not yet ploughed up a start should be made at once. The cultivation should be of the best, and the land cleaned by frequent working. If the land is at all sour an application of lime should be made and worked in.

Those who are holding last season's crop should now bulk it down. This is done by placing two rows of hands, overlapping by about one-third of their length, with the butts outward. Build up in this way to a height of 3 ft. or 4 ft. Weights should be placed on the top of each bulk, which should be covered with a tarpaulin, the object being to conserve the heat and moisture and avoid drying out the leaf, as well as keeping it in darkness. For this operation the leaf should not be moist, but in such condition that the tips can be squeezed together without breaking and that a slight shake will release one from the other. Examine the bulk daily for a while, and, if found too warm (over 100° F.), it should be broken down, aired, and restacked. The product improves with age if kept under proper conditions.

SHRUBS, LAWNS, DRIVES, ETC.

The planting of trees, shrubs, and perennial plants should now be completed. This is specially urgent on light land in the drier districts. The same expedition is required where lawn-grass seed is to be sown. Secure a firm, even, properly graded seed-bed, and sow it down now as soon as the weather permits.

Grass on playing-greens will now be making considerable growth and will require cutting. Where the grass is young, autumn-sown, or mostly young (through resowing and top-dressing), it must be cut with care. To cut it down hard is to lose it. A perfect and fast-playing surface cannot be expected the first season under ordinary conditions. Follow up the cutting by rolling and cross-rolling the lawns.

Yards, walks, and drives at this season are often disfigured and the surface drainage interfered with by the growth of grass and weeds at the sides and in the water-tables. Where any extent has to be dealt with, hand hoeing is costly and spoils the surface. A weed-killer mentioned, among others, in the *Journal* for May, 1922 (page 304), will be found effective for this purpose, and it should be quite safe if handled by an adult. It is composed of 1 lb. arsenic and 2 lb. caustic soda placed in a kerosene-tin three parts full of soft water. After a few days the arsenic and soda will have dissolved. Stir the solution well and dilute it to 40 gallons, when it may be applied through a rose watering-can.

In such a climate as is enjoyed by New Zealand, pot-plants of different kinds are in great demand for furnishing the airy rooms, verandas, and balconies of domestic and business houses. Be the position ever so dry and sunny or shaded, plants of some kind may be found to suit it. Quaint succulents—cacti and aloes—enjoy the former, while ferns, hydrangeas, fuschias, bays, and many other shrubs prefer the latter situations. Properly catered for, such plants require but little attention if rightly placed. The present is the proper time for potting up such subjects, or repotting those which have overgrown their position. Most of them would benefit by the removal now of some of the old top soil and replacing it with a similar quantity from a good properly prepared compost. Let the rim of the pot or tub stand an inch or two above the soil to allow for watering.

—W. C. Hyde, *Horticulturist*.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

MARE WITH INTERNAL PARASITES.

"SUBSCRIBER," Otane:—

Kindly advise me how to treat a draught mare, eight years old, low in condition, scouring badly, and passing small thread-worms $\frac{1}{2}$ in. long and red in colour. I have given two doses of linseed-oil and turpentine, but the mare continues to scour and pass worms.

The Live-stock Division:—

Your mare is evidently suffering from parasitic infection. The prognosis in all cases is unfavourable, but particularly so when scouring has set in. In treatment the first essential is rest. Ordinary worm medicines are of little use, as their dilution is too great when mixed with the bowel-contents. Boiled milk, gruel, and similar food should be in the daily diet, particularly where diarrhoea is present. The following drench, given in a pint of milk each night and morning, is recommended: Ferri. ammon. cit., 1 dram; quin. sulph., 15 gr.; acid. hydrochlor. dil., 15 minims; tinct. nux. vom., 20 minims. It will be well not to graze your horses in wet or marshy paddocks.

POISONING SPARROWS.

"SUBSCRIBER," Rotherham:—

Sparrows are at present doing much damage to oat stacks, and I should be glad to have a satisfactory receipt for poisoning them. I have bought and tried two different brands of poisoned wheat, both of which kill yellowhammers, green finches, &c., but the sparrows appear to be too cunning to take the poison. This seems to be the experience of most other people with whom I have discussed the question.

The Fields Division:—

The following is a method which has been found effective in killing sparrows in Canterbury: Moisten 12 lb. of wheat with milk, and add 1 oz. of finely powdered strychnine. The birds should be fed with ordinary wheat for a few days before poisoning. Spread the grain immediately after treating it with the poison, and only in the places where the birds have already been fed.

PRUNING OF THE ISABELLA GRAPE-VINE.

"A. M.," Pukehou:—

Please advise me of the pruning of the Isabella grape-vine, outdoor-grown. I understand it needs different treatment to European vines.

The Horticulture Division:—

The Isabella grape-vine, being a very vigorous grower, will cease fruiting after a few years if its natural growth is restrained by pruning on the Guyot or rod-and-spur system. This variety requires a much greater freedom of growth. It can be grown on an espalier having the bottom wire 18 in. from the ground, two wires (one on either side of the posts) 9 in. higher, and two more 1 ft. higher. The laterals are packed in between the double wires as they grow, instead of tying them to single wires as on the ordinary espalier. A distance of from 12 ft. to 20 ft., according to the richness of the soil, should be allowed between the vines in the rows, and 8 ft. between the rows. Two permanent rods should be grown from the main stem, and the laterals pruned back yearly

to the base bud, forming spurs about 9 in. apart. If only a few vines are grown, more fruit can be obtained by growing permanent rods radiating from the main stem and spur-pruning them as above. The rods can be supported on forked sticks, and their number increased gradually from laterals as the vine increases in strength. To work the soil after pruning, the sticks can be withdrawn and the rods placed on one side. Summer pruning should be confined to pinching back the laterals to six or eight leaves above the bunches a little before the flowers open.

LUCERNE-GROWING IN HATUMA DISTRICT.

H. P. HOLE, Hatuma :—

I should be glad of advice about the growing of lucerne in this locality. Mine is limestone-country, but the flats where it would be most convenient to grow lucerne have an iron-sandstone pan about 8 in. below the surface. Water is inclined to lie on the surface in the winter, and the ground is baked hard in the summer, when it almost needs a crowbar to sink a post-hole. There are no creeks or streams in the paddocks. I presume that lucerne would grow for a while if the ground was clean and well limed, but would not establish itself and last for years.

The Fields Division :—

The conditions described are very common in the Hatuma and Waipukurau districts of Hawke's Bay, and it is very inadvisable to attempt the establishment of lucerne on such land. The roots will not penetrate the hard-pan, and the water-logged state so common under such conditions will kill the plant during the winter. Lucerne may be encouraged to grow for two or three years, but the initial cost of establishment, combined with the inferior crop which is sure to result, makes it a very expensive proposition.

DESTROYING GUM-TREE STUMPS.

A. L. FROST, Huapai :—

Gum-trees when cut down to the stump shoot up again. Kindly advise me as to the simplest and best method—without digging up the roots—to kill same.

The Horticulture Division :—

Some species of gums—blue-gum more especially—will shoot from the stump when a tree is felled. This tendency, however, is much less pronounced if the tree is cut down in summer. To destroy the stump without digging or using explosives the following method is usually successful: In the autumn bore one or two holes of 1 in. diameter and about 18 in. deep in the top of the stump, and put in each 1 oz. to 2 oz. of saltpetre; then fill the holes with water and plug up close. In the ensuing spring take out the plug, pour in a small quantity of kerosene and ignite it, and a good burn should result. The stump must be in a fresh, sappy state when the saltpetre is put in, or it will not penetrate the fibres thoroughly.

BACON BECOMING HARD.

“SUBSCRIBER,” Papakura :—

Can you please tell me how to prevent bacon, especially the lean meat, from becoming hard after a little while? We usually kill our own bacon and cure at home, using mostly salt and some sugar. Being but a small household, it is some time before the last is used, and usually it is then very hard.

The Live-stock Division :—

It is possible that your cure has been too hard—that is, the meat is allowed to remain in salt too long, especially when sides or pieces are small and thin. Shrinkage is taking place all the time after curing, and a certain amount of hardening in the lean is bound to occur when the bacon is kept for some time. You are advised to avoid using maize or beans when feeding for bacon, as these have a hardening tendency with the lean, but an opposite effect in regard to the fat.

WEATHER RECORDS: JULY, 1924.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE weather during the month of July was on the whole very dry, especially in the east-coast districts of both Islands. New Plymouth and Patea were the only places in the table of the North Island showing falls above the average for the month. In the South Island Westland and Otago had rainfalls above the average, but Dunedin and Invercargill were below.

Barometric pressure was very high from the 8th to the 11th, and on the whole rather higher than usual. The days were generally fair and sunny, but the nights were frequently cold and frosty. Auckland experienced one frost, on the morning of the 26th, but parts of Canterbury had frosts on twenty-five nights in the month. In the Wairarapa and some other parts of the North Island from twenty-two to twenty-three frosts occurred, and Wellington had fourteen.

There were two very cold spells—one from the 3rd to the 6th, and the other between the 20th and 25th. The latter period was marked by heavy southerly winds, which arose from the development of a storm eastward of New Zealand. Snow fell during these two periods on the high country of both Islands. Excepting for these two disturbances, the winds were generally moderate and of a westerly tendency.

—D. C. Bates, Director.

RAINFALL FOR JULY, 1924, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.
<i>North Island.</i>				
	Inches.		Inches.	Inches.
Kaitia	2.78	13	0.58	5.96
Russell	2.63	11	0.94	4.26
Whangarei	3.52	19	1.11	8.33
Auckland	2.96	17	0.70	5.05
Hamilton	3.10	15	0.76	5.24
Kawhia	2.66	12	0.62	6.86
New Plymouth	6.98	18	1.51	6.35
Inglewood	9.74	17	2.03	9.93
Wangamomona	6.94	15	2.28	7.68
Tairua, Thames	3.00	11	0.90	5.15
Tauranga	2.91	11	0.66	4.94
Maraehako Station, Opotiki	3.06	10	1.28	4.45
Gisborne	1.64	12	0.38	5.21
Taupo	3.06	10	0.86	4.21
Napier	1.27	6	0.59	3.82
Maraekakaho Station, Hastings	1.54	11	0.62	3.65
Taihape	2.08	16	0.55	3.33
Masterton	1.70	16	0.49	4.43
Patea	6.75	12	1.81	4.10
Wanganui	2.43	7	1.00	3.63
Foxton	3.12	9	0.82	3.26
Wellington	2.97	14	0.52	5.65
<i>South Island.</i>				
Westport	7.37	19	0.95	6.99
Greymouth	8.82	20	2.05	8.43
Hokitika	10.46	19	2.74	9.10
Arthur's Pass	12.18	12	4.56	12.53
Okuru, Westland	12.30	12	2.56	12.03
Collingwood	8.24	13	1.78	9.65
Nelson	3.49	10	1.60	3.47

RAINFALL FOR JULY, 1924—continued.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.
<i>South Island—continued.</i>				
	Inches.		Inches.	Inches.
Spring Creek, Blenheim ..	1.99	9	0.56	3.93
Tophouse ..	4.39	9	1.03	5.65
Hanmer Springs ..	1.47	8	0.35	5.15
Highfield, Waiau ..	0.70	6	0.22	3.63
Gore Bay ..	1.63	8	0.53	3.31
Christchurch ..	1.49	10	0.72	2.77
Timaru ..	0.28	6	0.14	1.95
Lambrook Station, Fairlie ..	0.82	3	0.42	2.72
Benmore Station, Omarama ..	2.07	13	0.65	1.74
Oamaru ..	0.26	5	0.11	1.78
Queenstown ..	4.01	14	0.93	2.01
Clyde.. ..	1.25	9	0.25	0.94
Dunedin ..	2.14	11	0.78	2.99
Gore ..	2.90	14	0.70	2.05
Invercargill ..	2.98	22	0.34	3.41

Wool-control.—The question as to whether the New Zealand Wool Committee should be reappointed was referred to the Board of Agriculture. The opinion was expressed at the last meeting of the Board that the committee had done very good work in allocating the quantity of wool for the local sales in the various districts, and that it would be well that it should be continued. A resolution was passed that such a committee should be set up, consisting of two members to represent the sheepowners, to be appointed by the Sheepowners' Federation and the Defence Committee of the Farmers' Union in the Wellington Province; two to be appointed by the Wool-brokers' Association; and one farmer to be nominated by the Government.

Viticulture and Winemaking.—Last season was a favourable one for all classes of grape-growing, and crops were above the average and comparatively free from disease. The vintage was estimated to produce 80,000 gallons of wine, representing a value of between £30,000 and £40,000. Table grapes grown under glass were valued at approximately £30,000. A good demand is reported for grafted vines of both wine and table varieties.

Australasian Association for the Advancement of Science.—The seventeenth meeting of the association will be held at Adelaide during the week commencing 25th instant, under the general presidency of Sir John Monash, Chairman of the State Electricity Commission of Victoria. The president of the Agriculture and Forestry Section is Dr. S. S. Cameron, Department of Agriculture, Melbourne; and Dr. S. Dodd, of Sydney University, presides over the Veterinary Science Section.

British Market for Peas and Beans.—The following advice was cabled by the High Commissioner, London, on 8th August: *Peas*—Demand for blue is limited to best. "A" grade Tasmanian, spot value about £20 per ton; July–August shipments, sellers £18, buyers £17 10s. c.i.f. Partridge No. 1 (New Zealand) offered August–September shipments at 72s. 6d. per 504 lb. c.i.f.; September–October shipment, 75s., but buyers' idea about 68s. to 70s.; spot new crop offered at 77s. 6d., old crop 70s. ex store. Japanese (green) offered at £19 10s. per ton ex store and for shipment c.i.f. For maple, English quiet at 56s. to 60s. for good quality; New Zealand best-quality spot, 60s. to 68s.; Tasmanian August–September shipments offered 72s. 6d. afloat, 75s. c.i.f.; ex-store value 75s. to 81s. *Beans*—Market quiet. English choice winter 49s. 6d., spring 58s. to 68s., per 532 lb. Chinese horse, July–September shipments sold at £10 10s. to £10 12s. 6d. per ton.

GRADINGS OF BUTTER AND CHEESE, 1923-24.

THE quantities of butter and cheese graded for export by the Dairy Division during the year ended 31st July, 1924, were as follows:—

Butter: Salted, 58,327 tons; unsalted, 3,484 tons: total, 61,811 tons—a decrease of 8.9 per cent. compared with the figures for the preceding twelve months.

Cheese: White, 45,374 tons; coloured, 28,573 tons: total, 73,947 tons—an increase of 20.7 per cent.

In terms of butterfat, the 1923-24 amounts for butter and cheese combined represent a net decrease of 0.17 per cent. compared with those for 1922-23.

PRECAUTIONS AGAINST FOOT-AND-MOUTH DISEASE.

UNDER an Order in Council dated 4th March last the importation of oats, barley, maize, hay, straw, and chaff from the United States of America was prohibited. Another Order, dated 30th July, has extended such prohibition as follows:—

(a.) Plants or portions of plants, all fruit and vegetables (other than dried, canned, pickled, pulped, or bottled fruit and vegetables), and all grain and farm-produce in addition to oats, barley, maize, hay, straw, and chaff, as already prohibited: Provided that in the case of all goods the importation of which is prohibited under this paragraph and not grown in any of the States of California, Oregon, and Washington, or directly handled or exposed within any of those States, otherwise than is necessary for through transportation to New Zealand, importation shall be permitted if the goods are accompanied by a certificate signed by a person appointed in that behalf by the Government of the State concerned, and countersigned by a responsible officer of the Federal Department of Agriculture certifying—(i) The name of the State in which grown; (ii) that such State is, and has been for not less than twelve months, free from foot-and-mouth disease; and (iii) that the goods under certification have not been directly handled or exposed within any of the States of California, Oregon, and Washington otherwise than is necessary for through transportation to New Zealand.

(b.) All hay, straw, chaff, or husks used as packing-material for goods of any kind, unless accompanied by a certificate signed and countersigned as aforesaid certifying such material to be the produce of a State other than the States of California, Oregon, and Washington, and that it has not been directly handled or exposed within any of those States otherwise than is necessary for through transportation to New Zealand.

IMPORTATION OF FERTILIZERS: JUNE QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the quarter ended 30th June, 1924: *Sulphate of Ammonia*: From Australia, 175 tons; Belgium, 5 tons. *Nitrate of Soda*: Chile, 20 tons. *Gypsum*: Australia, 309 tons. *Basic Slag*: United Kingdom, 9,576 tons; Belgium, 13,908 tons; Netherlands, 201 tons; France, 105 tons. *Bonedust*: India, 315 tons; Australia, 527 tons. *Chardust*: Australia, 150 tons. *Guano and Rock Phosphate*: New Caledonia, 2,100 tons; Nauru Island, 28,830 tons; Makatea Island, 605 tons. *Kaimit*: United Kingdom, 715 tons; Belgium, 110 tons; Germany, 295 tons; France, 300 tons. *Muriate of Potash*: United Kingdom, 1 ton. *Sulphate of Potash*: United Kingdom, 95 tons; Belgium, 25 tons; Germany, 115 tons; France, 25 tons. *Potash, other*: United Kingdom, 295 tons; France, 150 tons; Germany, 295 tons. *Sulphate of Iron*: Australia, 12 tons. *Miscellaneous*: United Kingdom, 2 tons; Germany, 1 ton.

Noxious Weeds.—The Eketahuna County Council has declared wineberry to be a noxious weed within that county. Californian thistle has been declared by the Lake and Taieri County Councils not to be a noxious weed within their respective districts; ragwort has been similarly declared by Lake County.